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CONTENTS.

THE

JOURNAL OF AGRICULTURE.

LETTERS ON SCOTTISH AGRICULTURE.

By JAMES F. W. JOHNSTON, F.R.S. L. & E., F. G. S., &c.

ONE of the duties imposed upon me as chemical officer to the Agricultural Chemistry Association of Scotland, is to make observations "regarding the mode of culture followed in any particular district, with a view either to its improvement or to its adoption elsewhere," and to make occasional reports to the Committee of Management on the subject. Many things of lesser note, however, have struck me in the course of my professional visits to different parts of the country, which, though not worthy of a place in any formal report, are yet, I think, not undeserving of being brought, in a plain and unpretending manner, under the notice of my agricultural friends. I propose, therefore, from time to time, as my leisure permits, to put together, in the form of familiar letters, the isolated scraps of knowledge which I have, and thus collect, or which the facts and usages I observed recall to my recollection.

LETTER I.

To WILLIAM MAXWELL ALEXANDER, Esq. of Ballochmyle.

MY DEAR MR ALEXANDER,—I have just returned from a short visit to Fife, and, as I have been much of my time at Balcarres, and among the tenants and neighbours of your friend Colonel Lindsay, I am sure you will be glad to receive a few notices regarding the intelligent farmers of that part of the country.

On my way by coach from Kirkaldy to Colinsburgh, as the ground was still partially covered with snow, I saw only two

things likely to interest you as an agriculturist. The first was about an acre of potatoes left in the drills as they had grown, in the hope that they would, when lifted in spring, prove better for seed. This was an indication both that the potato failure had been much felt in this district and that skilful farmers were trying reasonable methods with the view of preventing it for the future.*

This disease in the potato has already called forth many hasty opinions, almost all partially true, because founded on one or two facts, but nearly all unsound as general expressions of the truth, since they are contradicted by the experience of other practical men in other districts of the country. Such is, I believe, the case with the method of planting in autumn recommended by Mr Gray of Dilston, and which we last year saw under trial on the farm of our friend Mr Burnet of Gadgirth, in whose hands it failed; and such will be the case with the latest of the *infallible* cures† which has been propounded, that of cutting the sets in autumn or winter, before the shooting of the tuber in spring commences. I was told in Dumfriesshire of extensive failures where whole potatoes were planted—a circumstance which shews that the mere prevention of bleeding by cutting in autumn is not to be regarded as a universal remedy. We are clearly unable, as yet, to assign either any general cause for the disease or any universal remedy. Something may possibly be suggested by the analyses of sound and diseased potatoes, for which the Highland Society has offered a premium, though, in the present state of our knowledge upon the subject, even this is doubtful. The most that chemistry has yet done for this question is in the shape of suggestions for experiment; and, in the hands of Mr Fleming, such experiments have so far shewn that top-dressing with saline mixtures, not only doctors the existing plant, but strengthens the tubers produced, so that, when afterwards employed for seed, they are less liable to failure than others to which, during their growth, no saline mixture had been applied. It has occurred to me, in addition to the numerous other precautions hitherto recommended, that, if the potato sets, after cutting, could be steeped for a few hours in a very strong brine, containing also a little sulphate of magnesia, and then dried with gypsum, after Mr Fleming's method, some advantage might accrue. Could you still try this?

The other point which struck me as I travelled along was the

* Mr Samuel Girdwood, whose agricultural skill is well known in Bute and Ayrshire, writes me thus:—"I have known the plan of keeping those intended for seed in the ground all winter, undug, tried for several years past with uniform success."

† "The Potato *Problem* Solved." By Robert Arthur.

ber of rats with which one or two farms, within a
dinsburgh, were said to be peculiarly infested. In
n-yards we passed, the stacks appeared to be com-
with their holes. It is a large species of field-rat,
eason of the year is driven, by the plough and the
shelter in the stack-yard. Why do these rats
n numbers on particular spots or in particular
e main reason must be that they find abundance
od. This food is most likely to consist of the roots
in the earth in winter. I am not aware to what
tack the turnips which are left in the field, but
resence of these rats indicate that certain peculiar
in the land, on the roots of which they delight to
olk, according to Mr Almack, the number of rats
ies almost amounts to a plague, and the extra-
utions of plastering the stacks for about three
bottom, and of digging trenches three feet deep
are had recourse to, in order to preserve the corn
ages.*

at Balcarres, I climbed the crag, and thus obtained
whole low country, and of the Lammermuirs, still
now, on the other side of the Firth. This country
ts resembles that part of Ayrshire with which you
r. It consists of humps of trap rising up through,
ading over, the various beds of rock which compose
d the coal measures. The soils are also formed from
sses of rocks. The old naked lavas—for the trap
s are only old lavas—have gradually crumbled
rmed rich soils, while the shales and sands of the
s have produced cold clays or hungry sands, or un-
stony gravels, all of which require very different
lture and improvement from the soils which trace
to the trap.

is more perplexing to the farmer than the varied
ne in different parts of such a district. I am sure
et the very interesting meeting of the St Quivox
lub, at which we were present in Ayr, in October last,

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* n Strawless, Norfolk, I first observed ricks plastered round, for about
the bottom, with mortar, to keep the rats out. The cost of doing a
thus (Mr Bowman thought) had been about 12s., and the old plaster
th (as manure) nearly half the money. I observed several instances
neighbourhood of Blofield, some of the parties having also dug a
t a yard deep, round the stacks. In some parts of the country the
n iron stands (or frames) for the same reasons. Mr Blyth of Burnham
l great ingenuity in constructing a cheap one, from loose bars of iron
The number of rats now infesting the country is little short of a plague.
IACK, *Roy. Ag. Jour.*, v. p. 330.)

when the subject of discussion was the use of lime, and the very contradictory opinions which the most intelligent practical men expressed on that occasion. One unacquainted with the subject, would have considered it very strange and puzzling to hear, as we did, one-half of the fifty farmers there assembled declare, from *their own experience*, that lime was of no use whatever; while the other half thought favourably of it, and some, who had been laying it on at a cost of several hundred pounds a-year, announced their intention of continuing to do so, because of the profit they derived from it. What would a merchant have thought of such contradictory opinions? How little skill, he would say, must these men have—how very uncertain the art they cultivate—how destitute of fixed principles on which a prudent man may rely!

And yet the stranger would err in thus supposing either that the art of culture is destitute of fixed principles or that those who prosecute this art are inferior in natural intelligence to the cultivators of any other art. The art is not destitute of principles nor the farmers of clear heads and strong natural sense; but these principles have never been distinctly stated to them—never put before them in the form of regular instruction, when their minds were young and open, or, since they have been concerned with the cares of life, exhibited as a clear and obvious source of larger profit. Diffuse a knowledge of principles, and contradictory opinions, as well as contradictory practice, will disappear.

Each case of success or failure, from any mode of treating the land, will have its own specialities, and must be studied by itself; but it is obvious that if one soil contains naturally a large proportion of lime, while another contains almost none, the application of lime to the former must, as a general rule, be much less beneficial than to the latter. Now such is the case with the soil formed from the trap rocks. It contains naturally much lime. The rock of Balcarres Crag, for example, from an analysis made in my laboratory, appears to contain in every four tons as much lime as is present in one of pure limestone. There must be much, therefore, in the soil that is formed from such a rock. Now, in Ayrshire and in Fife, these rocks appear here and there in patches of greater or less extent over the breadth and length of both counties; and their crumbling or *rotten* portions form isolated tracts of fertile soil. Those who farm these soils may conscientiously and correctly declare that, on their land, while they have held it, lime has done no good; while their neighbours, who farm the cold clays of the adjoining coal measures may be applying it with a *certain* hope of profit. The road-scrapings which the former despise, the latter may find to act upon their

grass-lands, or on their green crops, like a moderate application of marl.

In connexion with this latter observation I may mention to you, as a curious fact, that the road-scrapings from Leith Walk and some adjoining streets, which are *metalled* with broken trap, are carted to the sea-shore at Leith, at an expense of £700 a-year, to be washed away and wasted by the tide. It is even said, I do not know how correctly, that parties are prohibited by a penalty from carrying any of this refuse away for the purpose of applying it to the land. To make them sensibly useful, these scrapings should be laid up in heaps for a year, to allow the silicates they contain to undergo partial decomposition.

I had the pleasure of meeting at Balcarres a number of the most intelligent farmers of the district, whom Colonel Lindsay had been kind enough to bring together. We had much conversation in the course of the evening, and we mutually put and answered many interesting practical questions. My friend and pupil, Mr Norton, who was a spectator and listener, expressed, the following day, what I had myself thought, that, during our many excursions, he had seldom met a more intelligent and less prejudiced company of practical men. They were not all from the immediate neighbourhood of Colinsburgh, some of them, whose farms I should like to visit, had come from Leuchars, the district which lies between the Eden and the Tay.

Among the topics to which our conversation turned was that of feeding with different kinds of turnips, and to their use with or without tops. When given to milk cows, I found the opinion here to be, that white turnips produced much *more* milk than Swedes, some said twice as much, but all allowed that yellow turnips gave a *richer* milk. Still that the same weight of globes should give so much larger a quantity is not easily explained, since the difference in the relative proportions of water they contain is comparatively trifling.

I asked some questions about turnip tops. All agreed that the turnips gave more milk when the tops were given along with them. This also must arise from some other cause than the quantity of water they contain, since, according to experiments made in my laboratory, the

Bulbs of Swedes contain	88 per cent. of water,		
Tops of Swedes contain	85	...	...

so that the *quantity* of milk must depend upon the chemical composition of the tops, and not merely upon the water they contain, since the bulbs contain the most.

A difference of opinion prevails as to their use in the feeding of growing and fattening stock. I am inclined to concur with

one or two of the practical men present, who pronounced them to be good feeding, when given with a proper admixture of hay, straw, or other dry fodder, and especially to *young stock.* I am inclined to this opinion in consequence of the very interesting result of an analysis I am now making of the tops compared with the bulbs of the turnips. These experiments are not yet completed; but, so far as they have gone, you will see how practically interesting they are, from the following facts in regard to Swedes:—

	Water.		Dry Matter.
1° A ton of *bulbs* contains	1970 lbs.	and	270 lbs.
A ton of *leaves* contains	1900 lbs.	and	340 lbs.

Or the leaves contain, in the same weight, one fourth more dry food than the bulbs.

2° A ton of the *bulbs* gives 17 lbs. of ash.
A ton of the *leaves* gives 33 lbs. of ash.

Or the leaves, weight for weight, take from the soil twice as much as the bulbs do. Of course they convey into the stomach of the animal, in these same proportions, the inorganic substances of which the ash consists. But further—

3° In the ash of the leaves a much larger proportion than I had anticipated consists of the earthy phosphates—chiefly the phosphate of lime, of which, as you recollect, the earthy part of the bones in a great measure consists. Thus

A ton of *bulbs* contains 3 to 6 lbs. of phosphates.
A ton of *leaves* contains 10 lbs. of phosphates.

So that not only does a given weight of *leaves* exhaust the soil of phosphates in a greater degree than an equal weight of *bulbs*, but it is also fitted to give to the animal more of those materials from which the bones are to be formed. Hence the reason why I am inclined to concur in opinion with those of the Fife farmers, whose experience had led them to consider the turnip tops a nourishing food for young stock. And as milk contains and requires for its production a considerable supply of these phosphates, it is not unlikely that the increased yield of milk caused by the turnip tops may be in some measure owing to the large proportion of phosphates they convey into the stomach of the animal. Of course, every practical man knows that, if any food scours an animal, as turnip tops are sometimes said to do, it may prove injurious when given in too large quantity. It will be necessary, therefore, to give some other, perhaps some dry food, along with the green tops, to check any tendency they may have to produce this effect in an improper degree.

In regard to turnip tops, another opinion entertained by some of the Fife farmers attracted my attention. It is said that if the

turnip tops are left in the field, and only the bulbs carried off, the land will be as much benefited as if the *whole* be eaten off with sheep. I do not know how far experience bears out this opinion —of what kind of soils it is correct—nor in reference to what kind of sheep. I shall make further inquiries, therefore, before I venture to offer you the explanation of the alleged fact which at present occurs to me.

I shall trouble you with only one other fact, observed in the south-east coast of Fife, which, in your inland position, however, may not be of much practical value to yourself. When sea-weed is laid on the stubble in autumn, and ploughed in at the rate of twenty-five tons an acre, and the turnips afterwards raised with half dung, *the red clover which succeeds is never known to fail.* Does this imply that saline matter, such as sea-ware contains, is a specific against such failure, or may not the mildness of the climate along the sea-shore secure the red clover plant against the injury it often receives from the premature frosts of an early winter?

On the following morning I had the pleasure of addressing a large audience of practical men in Colinsburgh—Mr Bruce of Kennett in the chair. It was on the occasion of the Annual Show of the East of Fife Agricultural Society, and the hour of lecture was very judiciously fixed at half-past nine, by which means I was enabled to dismiss my audience before the proper business of the day commenced. This is an important consideration, and should, I think, be kept in mind whenever lectures or discussions are fixed to take place at such agricultural meetings. Mr Bruce also presided at the dinner, which went off very successfully. One thing struck me as peculiarly worthy of imitation, that by seven o'clock—the dinner having been fixed for three—every person had left the room, the chairman being the last to quit, and most of the farmers were already on their way home.

You know the natural richness of the land in this district. It labours, however, under two natural disadvantages. In many parts it is wet, and requires drainage to make it more, or more uniformly, productive. It contains also much oxide of iron in the subsoil, especially of the richer and opener land, which rests upon the trap. This iron is derived from the trap itself, which not unfrequently contains a very large per centage of this metal. In soils which are formed from decaying trap, it sinks or is washed down by the rains, and in many places collects in the under soil. I have seen very instructive examples of this upon the home-farm of Balcarres. Beneath the first twelve inches of black or brown soil there are twelve or fifteen inches dotted with red or ochrey spots, and below this occasionally the whole is a wet and ochrey mass. The same appearance presents itself in many other parts

of this county, and indeed in many other counties of Scotland; and, were I not afraid of making this letter of a tiresome length, I could mention some very curious facts in regard to it, quite as interesting as those I picked up two years ago on your own home-farm at Southbar. The roots of plants cannot, of course, descend into such subsoils, and the crops not unfrequently droop and fail after they have come into flower; because their roots have reached the noxious matter. The cheapest, and perhaps the only available, general method of remedying this evil is by the insertion of drains.

But of the means of draining, at least with tiles, this part of Fife has hitherto been deficient. It was with much satisfaction, therefore, that I visited the tile-work now erecting on Etheridge's principle, at the joint expense of Sir Ralph Anstruther and Colonel Lindsay, between Kilconquhar and the sea. The work will be on an extensive scale; and, as the clay is of excellent quality—as Etheridge's machine leaves nothing to be desired in regard to the workmanship of the tile—and as the proprietors propose to sell their tiles at the cheapest possible rate, many years will not elapse before the eastern part of Fife becomes still more distinguished for its productiveness and good farming than it has hitherto been. Indeed, while improvement is going on so generally—while almost every proprietor and every county are striving with their neighbours—any estate or district which stands still must necessarily appear to fall behind in the universal progress.

My limits do not permit me to do more than advert to the success which has attended Colonel Lindsay's distribution of a part of his land, around Colinsburgh, in small allotments to the poorer inhabitants, and to the amount of health and comparative domestic comfort he has thus been the means of diffusing among the humbler peasantry of the district. Many persons are opposed to the system; and, on the part of a proprietor who is not acquainted with its actual results where it has been long introduced, I can understand why evil results may be reasonably anticipated; but I confess I do not see why it should meet with opposition from an enlightened tenantry. I was told the other day, by a friend of ours, that the tenantry around one of his estates, in the south of Scotland, were not only opposed to it, but had publicly announced that they would not employ a labourer who was the holder of an allotment. A hard measure this is surely, and an unkind one to the industrious labourer. Is he supposed to have no fraction of strength left after his day's work is conscientiously performed—and are his wife and children to be debarred from contributing their mite towards the common support of the family?—I am, &c. JAMES F. W. JOHNSTON.

LETTER II.

To David Milne, Esq., of Milne-Graden.

April 31, 1845.

My Dear Mr Milne,—As you were prevented from making your intended excursion into Forfarshire, you will, I daresay, be glad to hear some account of my proceedings and observations in the eastern part of that county.

I met Sir John Ogilvie in Dundee, on Thursday the —— and as it was the fast-day in that town, we went out at once to Baldovan, and, before dinner, walked over the home-farm.

The estate of Baldovan, of which the home-farm forms a part, lies between the Dundee Law on the south and the Sidlaw Hills on the north—the former consisting, as you know, of trap, the latter of the old red sandstone rocks. In the valley by which these two great elevations are separated, there occur, here and there, knolls or sloping hills of trap, which give an undulating character to the country, and materially affect the agricultural value of the soil upon different parts of the estate. On the slopes of the trap hills, of course, the soil is mainly formed from the decay of the trap itself, and is mixed with many fragments of this rock. Towards the Sidlaws, the debris of the sandstone prevails more, as it does also along the bottom of the valley where the little stream runs, brought down, no doubt, by floods from the higher country.

You know that our Edinburgh and Ayrshire traps, and those of Fifeshire, *generally* produce, by their decay, a reddish soil. They abound in iron, which often sinks and accumulates in the under soil, injuring the roots even of apparently flourishing crops, and giving rise to the local saying in Fifeshire—"that the oats or beans have gone to Auchtermuchty." The trap of the Law, however, produces a dirty grey soil, at least, such is the character of the land in cultivation on its northern slopes, in which fragments of this trap abound; and the rock itself differs in appearance and in its mode of decay, when seen in the quarry, from those of the counties I have mentioned. I suppose it to be deficient in iron, and, perhaps, in lime; in other words, to abound more in felspar than others of our trap hills. It is undergoing analysis, however, in my laboratory, and I hope to be able, by-and-by, to form a more decided opinion upon the subject. This composition of the rock has important and practical bearings, inasmuch as it is connected with the quantity of lime, and the matters which the soil may naturally be expected to contain, and with the steps,* therefore, which it will be proper to take for its improvement.

You understand the geology of Eastern Forfar too well to sup-

* See "Johnston's Catechism of Agricultural Chemistry and Geology."—P. 22.

pose, from what I have said, that the whole slope of this valley, from the Law northwards, consists of trap; for, though trap rocks do present themselves, here and there, on the north banks of the Tay, from Dundee all the way down to Broughty Ferry, yet they are very far from being continuous. They burst up through the red sandstone rocks, which are frequently seen at the surface, and admit of being quarried, and which have given rise to fields of poor and stony soil, that are scattered at intervals among the richer corn-lands of the trap. The home-farm of Baldovan has its share of this poor land, and I especially noticed a patch of twenty to thirty acres which had long been an open common, but which Sir John has partially inclosed, drained, and subsoiled, and will, by-and-by, be able to cover with a sward of grass, which will, I hope, amply remunerate him for the large outlay he has expended upon it.

It is but a morning's ride from Edinburgh to Dundee, and, in a couple of years more, it will be a two-hours' journey only; and yet at the back of the Dundee Law, improvement, during the past generation, has proceeded at as laggard a pace as in some more remote districts. There are some fine farms in the district, and some most skilful farmers; and if you were to go with me to Dundee market, I could pick you out twenty or thirty practical men, whom for knowledge and intelligence, and a desire to improve, ingrafted upon that rare and prudent temperament which makes every step they take a sure and safe one, you will not easily surpass in other parts of Scotland. And yet, in the neighbourhood of these men, improvement has been so slow, that even the example and stimulus of the commercial enterprise of Dundee has been unable to drain and subsoil the land from which its inhabitants draw the potatoes and the milk for their daily consumption. I fancy it is incorrect to suppose that large commercial towns sweep into their own vortex all the enterprising spirits and spare capital of their neighbourhood, and embark them in the prevailing and popular line of commercial speculation, and yet facts are not wanting which would appear to support such an opinion. How otherwise can we explain why those neglected tracts of land we have so often seen in the neighbourhood of Glasgow are allowed still to groan under their perennial load of rushes; that, while the merchants of Glasgow are lavishing their tens of thousands in draining the swamps of Demerara and Jamaica, the marshes around their native city should be permitted to shiver in primeval coldness?

But the drain is now beginning to score the slopes behind Dundee, and deep-ploughing to bring new food within the reach of the plant. In the course of our walk, we went into one of the fields of an adjoining farm, where the tenant, a most industrious man, was himself holding the plough. We found the land in fine

condition, and the plough turning it over to a depth of ten or twelve inches, and I naturally praised his deep-ploughing. "Aye, sir," he said, "the farm would hae just clean done me, gin I hadna deep-ploughed."

The thorough-draining now going on in this immediate neighbourhood, has been in a great measure either the actual work or consequence of the example of Sir John Ogilvie. We know it is but a few years since he became a farmer, and the way in which his attention was drawn to it shews how much good may be done, indirectly and by accident as it were—more correctly speaking, by the use of those various means of diffusing agricultural knowledge, which it is one of the main objects of the Agricultural Chemistry Association to promote. He was leaving Edinburgh one morning for home, when a friend put into his hand Mr Smith of Deanston's pamphlet on draining, to amuse himself with by the way. He read it, and said, what could be done for his own land. On reaching home, he was waited upon by the tenant of one of his wettest farms, who wished either to give it up or to have a reduction of rent. He took the tenant at his word, allowed him to quit, and became a farmer himself. It was amusing, he told me, to see the shrugging of shoulders among some of the farmers he consulted, when he told them of his intention to drain what they were in the habit of considering dry land. But the perennial flow of water from the first drains he cut, and, above all, the striking fact that what were formerly the worst fields of the farm, gave, after draining, the best crops—these quickly satisfied the most intelligent and the most money-making of his neighbours, so that some of these are now doing quite as much, and doing it as efficiently, as himself. It is astonishing how much good may be done, without any great exertion and without any expenditure, which a skilful tenant will not afterwards readily make for himself, by the example and presence of a resident proprietor who really knows something of the *principles* of agriculture.

I was much interested by a visit we paid to the farm of Mr W. Cobb, one of the largest farmers in this part of the valley. I found him draining a field which, a few years ago, he said they would have considered dry enough. His drains were eighteen feet apart and thirty-three inches deep. From some remarks I had made in my lecture the preceding day, he said he should in future make their depth three feet, which, for stone drains, is sufficiently shallow. He does all his draining at his own cost—of course he has a nineteen years' lease—and he reckons, as the Berwick and Roxburgh farmers have told me, that his whole outlay is repaid by the increased produce in two or three years.

The subsoil-plough is here, as it ought ever to be, the follower

of the drain. Mr Cobb has found the difference it produces upon his potatoes so great, that he proposes to subsoil his land every rotation. He is at present altering his ploughs, that he may be able, in going over his land again, to plough three inches deeper than before, making twenty inches in all. How can our Ayrshire friends ever get to this stage of improvement while the *bottoms* of their drains are little more than twenty inches from the surface? A well-known farmer in this district, Mr Drummond of Craigie, remarked to me that the land in this county is not half ploughed with the common plough; I believe the same may be said of much of the land of Ayrshire.

The system of farming here is peculiar when compared with that of the country in general. It resembles, however, in many respects, that which is practised in the neighbourhood of Glasgow, Paisley, Edinburgh, and others of our large towns, where markets are constant and easily accessible, and from which manure in any quantity may readily be procured. Everything is sold off the field as it stands. The potatoes and turnips to the dealers and cowfeeders of Dundee, and the standing corn, more or less entirely, to jobbers. The seller is bound to cart the produce to Dundee, but his teams generally bring back manure. A quicker return of his expenditure is thus made to the farmer, and, by selling in small lots to suit his customers, a price is obtained for the green crops which by many is considered quite equivalent to the profit which might be made by using them on the farm in fattening stock. It is a drawback to the system that, at this season of the year, when the land is preparing for the seed, the turnips are sometimes still on the ground into which the farmer would like to send his ploughs, and that, when busy at other work, his horses are often called from the field to take produce into Dundee. This, however, is partly counterbalanced by the less degree of exhaustion produced by those turnips which are longest left in the ground. Those which are carried away early in the season, and in full leaf, exhaust the land more than those which remain the whole winter through. During the cold months, they shed their leaves, and the early second growth of spring is chiefly at the expense of the turnip itself.

The rotation followed on the Baldovan home-farm, as well as on that of Mr Cobb, is in sevens, thus—1°, oats; 2°, oats, half or two-third dunged; 3°, potatoes with twenty loads of dung; 4°, wheat half dunged; 5°, turnips heavily manured; 6°, barley, half dunged; 7°, seeds one year. Sometimes the second crop of oats is omitted, in which case the rotation is in sixes. Many good farmers agree as to the propriety of taking two crops of oats after the clover hay, and, no doubt, where the sods are very tough, or the straw of the first oats very rank, the practice may

be the most suitable to the circumstances. It is doubtful, however, whether, after one year's clover, the practice can be generally recommended or defended. The singularity in the above rotation, you will observe, is, that besides the manure added to the green crop, every corn crop is half dunged. Perhaps this practice, which is demanded by the land for the purpose of restoring what is sold off, may also, in a certain degree, justify the second crop of oats.

Were I writing on this subject as a mere theorist, I might say that any course of rotation might be followed, and any crops taken which the farmer chose, and in any order of succession, provided the substances which the crops carry off from the land are faithfully restored to it. This is a favourite doctrine at present among some agricultural theorists. But the study of practical farming has taught me that this kind of closet cultivation would not produce good returns on all our soils. The *mechanics* of agriculture are almost as essential to the management of the soil as the *chemistry* of agriculture ; and it is because the former is not understood in our laboratories, that the confident announcements of the mere chemist have hitherto been so frequently at variance with the practical experience of the money making farmer. The natural habits of the plant we seek to grow have also much to do with the mode of culture. A minute knowledge of varieties, even of the same plant, is often a very important element in successful farming. Thus Mr Cobb takes for his first crop the early potato oat, which he sells off the land at £10 to £12 per imperial acre, being bound, however, to thrash and cart the produce to Dundee ; but for his second crop he takes the common Angus oat, which he keeps for his horses. His reason for this is, that besides the greater value of the latter variety for his horses, the two varieties grow better, and give better crops in succession than could be obtained by two crops of either variety alone. Our chemistry is not yet refined enough, that is to say, we have not as yet made the necessary analytical researches, to enable us to do more than merely offer conjectures as to the cause of such differences as this.

As facts in agricultural statistics, it is proper to state that Mr Cobb purchases his manure at 4s. per ton, and that the wheat crops on his well-cultivated farm average thirty-two bushels per imperial acre, and that the average rent of the land which yields these crops is about £2 : 10s. per imperial acre.

I may here make one observation in regard to the *economics* of artificial manufactured or imported manures in a district such as this. It is of importance in reference to the manures which are produced and worse than wasted in all our large towns.

The farmers in the immediate neighbourhood of our large

towns sell nearly all their produce and buy nearly all their manure. They are thus at liberty to buy and to use that kind of manure which is at once the cheapest and the best. They have hitherto drawn much of this supply from the adjacent towns; because there they could alone obtain it. But the importer and the manufacturer now come into the manure-market and offer them better and more portable substances for enriching their land. One of two consequences will necessarily follow from this. Either the stablers, cowfeeders, and police-boards, who have natural manures to sell, will be driven out of the market, or else they must reduce the price and improve the quality of their commodity. They have science and commercial enterprise to compete with in an open market, and one or other of these consequences must follow. You know how great a reduction is stated to have already taken place in the revenue drawn from the Edinburgh police dung; and I fear it will be very difficult indeed to prevent further reductions from taking place.

Some sanguine persons are hastily asserting that the time will come when all our manures, used for every crop, will be prepared in manufactories and bought by the farmer as regularly as he buys his tea and sugar. This implies that all natural manures are to be wasted, and the management of dung heaps to be more neglected in future times than it has been during the past. But no such thing will happen. They will be saved, husbanded, and improved in quality more than they have ever hitherto been; because their value to the land will be more clearly and generally seen.

What chemistry will accomplish in regard to manures is clear and definite.

1°. It will cheapen, improve the quality, and increase the quantity of the manure collected and sold in towns. In some places it will drive it out of the market altogether.

2°. In rural districts it will supply the deficiency of home-made manure, and will provide what will gradually come to be considered a necessary and *paying* addition to the other manures hitherto added to the land.

Both of these consequences are important in a national point of view—since,

a They will lessen the expense of farming in the neighbourhood of large towns, while they will increase the produce, and, consequently, the profit of the farmer.

b They will increase the produce in the rural districts also, and, by this means, render the art of culture more profitable to the country farmer.

"I have used these chemical manures for the last five years," said a farmer to me who lives about ten miles from Dundee, "and I

have every year sold L.250 worth more produce in the markets." If half our farmers would increase their produce in a similar manner, do you think we should eat any more foreign corn?

I must defer my further remarks to a future letter.

Believe me yours very truly,

JAMES F. W. JOHNSTON.

SCHEME FOR AN ASSOCIATION IN ROXBURGHSHIRE FOR THE BENEFIT OF AGED HINDS. In a LETTER addressed to his GRACE the DUKE of ROXBURGHE.

MY LORD DUKE,—There are various reasons which induce me to address your Grace on the present occasion. The high station which you occupy in the county, from your elevated rank and extensive possessions; your nearly constant residence amongst us; your youth, which is the season for pure and gentle sympathies; and your general character for benevolence, which I have never heard impeached; all point you out as the individual who is the most likely from his disposition, as he is the most able from his circumstances, to foster any enlarged and liberal scheme for the welfare of his fellow men. In saying this, my Lord, I am aware that I am addressing you in something like the language of flattery, though, perhaps, not in the way in which it is usual to address flattery to the great. But my situation will take away all suspicion from my motives. I have never received any benefits from your Grace, and, therefore, I owe you no gratitude, except in so far as humanity in another deserves the thankfulness of all who have charity in their own hearts. Neither am I influenced by that kind of gratefulness which lies in the expectation of favours to come; for though, I trust, I am too lowly to despise kindness, yet I am too proud to use arts to obtain it, and should be sorry to think that I received patronage without being able to render an equivalent service. It is thus the language of truth and independence which I shall use in the course of the following letter; and I have no fear of its proving offensive, because I confide in your Grace's manliness.

The class of men on whose behalf I wish to excite your interest is perhaps as highly distinguished for its peculiar and precious virtues as any other within the limits of civilisation. All competent judges, who are thoroughly acquainted with the border hind, are untiring in their praises of his quiet industry, his

remarkable intelligence, his probity, his sobriety, his cheerfulness in a prosperity which never passes the narrowest bounds, and his resignation under sufferings which are often severe and enduring. The nature of his occupation gives a peaceful turn to his disposition, without rendering him timid or abject. The virtues of his character, therefore, and the intelligence and sturdiness of his spirit, bring him into full harmony with the free institutions of his country, and he is submissive to its laws, while he is conscious of his rights. Such men may, and do, enrich a country by their labour, or, if occasion offer, defend it by their arms; but they can rarely sink so low as to be burdensome by their indolence or costly by their crimes. Test any body of men by the requirements of their station, and not the highest and the best of them will shine in comparison with these.

The life of the hind must unavoidably be one of regular toil; of constant and earnest striving against the necessities of his condition. But it is far from my intention to bespeak sympathy for him on this score. His labours, in fact, are neither ungenial nor excessive; and, besides, a life of labour is that which is natural to our race. Since the utterance of that law which ordains "by the sweat of thy face shalt thou eat bread," all men have been constrained, as a condition of their existence, to pursue some occupation, profitable or unprofitable. This law the indolent man endeavours to avoid, and is miserable: the poor recognise it as their natural bond, and are the happier the more readily they succumb. The rich man obeys it, perhaps unconsciously, while he is engaged in the business of legislation, in the study of science or of literature, in the management of his estates, or even in the pursuit of those sports to which he devotes himself often with untiring diligence and unlimited expenditure. But obedience to this law has its rewards, as obedience to all laws should have reward with even greater certainty than transgression receives punishment: and happy are they who attain through it that which is the greatest of earthly blessings—without which wealth is a bauble and poverty a twofold misery—the possession of a sound mind in a sound body. It would be vain to ask for the hind an exemption from this our common lot, and unwise even to desire an alteration or a diminution of his toils. Let the ploughman with his team, the shepherd with his flocks, the sower with his stalworth step and liberal hand, still pursue, unwearying in zeal and faithfulness, their useful occupations, nor cease willingly, till age, gradually stiffening the sinew and retarding the step, shall finally release the disabled veteran from his task. Then, having lived, as the greater part of these men have always lived, without reproach; having fulfilled to the uttermost the duties of his condition; having been a faithful servant, a watchful parent, a peaceful subject, and a

pious Christian; let him glide at last into the grave as into a harbour of refuge: and let all those who have considered him well thus speak of him—that though he may be pitied for the hardships which have pressed sorely on the decline of his existence, he can never in any wise be despised as having sunk into that lowest of all human conditions, an old age without honour.

And here, my Lord, I come to that which is the special object of my letter. While the hind is in the vigour of his years, the daily work suffices for the daily life; and his scanty earnings are managed with a degree of economy and prudence which the rich man may content himself with admiring without pretending to comprehend. Neither he nor his children are ever seen in rags, and their dress on Sundays ought to be designated by a stronger term than respectable; while their minds are not left uneducated, and their countenances are usually ruddy with the hue of health. Yet this vigour of body, cultivation of mind, and respectability of appearance, is maintained in his family upon a wage which can rarely be estimated as amounting to thirty pounds a-year. Even for temporary sickness, or for any extraordinary casualty, he is not without some slight resources held carefully in reserve. But the store can never be an ample one; and, alas! it disappears ordinarily altogether before the exigencies of protracted illness or the feebleness of declining age. Thus, when the limbs totter and the eye grows dim, he must want that bread for which he can no longer labour, or seek it from the stinted charity of a Scottish parish; or, far better, from the kindness of a sympathizing neighbour. To such a man the grave is indeed a harbour of refuge, in which to seek shelter from the storms which beset the evening of life. His honesty, his enduring faithfulness, have not protected him from that fate which should fall only as a just retribution on reckless improvidence. Yet it is not fitting, my Lord, that we should forget by what inseparable links all classes of society are joined into one great chain of being, and that there is no such thing, to consider closely, as independence of man towards man; and, so considering, let us value the faithful servant whose direct usefulness has accomplished much for us, and his example still more; and let us cheer his fading prospects by placing before him the hope of some better companion for waning years and strength than sordid poverty.

But it is painful to remark how liberal the system of human polity, if it can be termed such, ever is in punishments, and how chary in rewards. Yet, if the reverse were the case, there can be no doubt that virtue would be more cheaply and effectually promoted, and in a way more creditable to the human character. The promotion of virtue must always be the repression of vice. But the contrary scarcely holds. The repression of vice is not

the promotion of virtue: It is merely a negation—a smothering of faults under fears. I have drawn a faithful picture, my Lord, of the border hind. There is not a trait in it that is borrowed from the fancy; not a tint that is other than a pure reflex from nature. If, then, it be a wise and a prudent policy to win from vice by marking out virtue for rewards, where shall we seek for fairer examples of it than among these men?

It is, indeed, the noble privilege of the rich to give; but I shall not now ask your Grace to bestow an ordinary alms. Mere casual charity could never effect the permanent and diffusive benefits which the occasion demands. Besides, if the act, as well as the desire, of benefiting a fellow creature be required to constitute charity, mere alms-giving will not always deserve this appellation. Alms may be given so as to steep poverty in deeper misery; and benevolence will generally be better employed in investigating the remote causes of destitution, so as to understand the nature of the evil it contends with, than in the distribution of that rapid, easy, and ostentatious relief, which is lavished without discrimination, and without consideration as to its ultimate consequences. Who can suppose, for an instant, that a system of bestowing aid which shall look to the mere existence of poverty as the sole foundation of claim, and shall inquire no farther into its causes or into the character of the claimant, can have any other than a deeply demoralizing effect upon our population? Surely where vice and improvidence are held entitled to look forward to the same immunities, in the hour of necessity, as prudence and virtue, there can be little regard to the great principles of justice, and, to wisdom and foresight, none whatever. Yet true it is, my Lord, that the sacred stream of charity flows but too frequently through tainted courses, administering to vices where it should relieve only wants. Intemperate and corrupt idleness demands, and almost forces, its supplies by importunate clamour; while honourable and industrious poverty, too busily occupied with its struggles for existence, has not leisure, if it has the inclination, to loiter at the fountain for the uncertain flowing of its waters. Deserving need shrinks from beseeching the bounty which it cannot usually attain without exposing distresses it is rather solicitous to hide; but the destitution of profligacy either unveils at once, unblushingly, its unsightly miseries, or feigns them, even where they do not exist, by a bold and specious lie. Thus the pure waters are drunk up by a foul morass, which changes into a pestilence that which was intended for a blessing.

But it may be said that thus to investigate causes would be a difficult and a tedious process, and such as ought to be expected rather from the calm reflection and earnest perseverance of the philosopher than from the ready effervescence of a kindly dispo-

sition having wealth at its disposal. If it be so, it is fortunate for my present subject that it requires to be illustrated by no such abstruse inquiries. My plea is now, not so much for the relief of poverty, as for the reward of merit; and I speak for those who are restrained from speaking for themselves by the motives and circumstances to which I have alluded. I repeat that I do not intend to solicit an alms. To requite desert is not charity but justice.

This aim of justice, so pure and so beneficent, may, it appears to me, be accomplished in a great degree by the establishment of an association having for its object the reward of old and faithful servants, by securing a certain annuity for life to such as had served at least fifteen years under the same master, and had finally become disabled from old age or infirmity. The necessary funds for this association might be raised by annual subscriptions, of not less than £1 each, from the proprietors and tenants of the district, it being understood that the servants of subscribers only should be eligible for the benefits of the institution. To secure its permanence, it would be desirable that it should be possessed of a considerable vested fund; and I would propose that the whole income for the first five years should be set aside as a capital, at no time and on no account to be infringed upon, but to be secured in the best way, and appropriated for ever to the interests of the association. Part of this permanent capital might be expended in the building of such a number of cottages as should be found requisite to accommodate the annuitants placed on the fund. No member, who had not been a subscriber to the institution for at least five years, should be held entitled to name a servant as a candidate for its benefits. Seniority and length of service would naturally be recognised as the principal qualifications; but where several claimants were proposed, equal in these respects, the decision would be made by lot. No one, however, should be admitted who should be under sixty years of age, at which age, it may be remarked, the average expectation of life will be somewhere about thirteen years. The allowance to each might be £20 per annum to a married man, and £15 to a single man, with the cottage, to which a small garden should be attached, rent-free. The cottages should be built in three different groups, of which one should be placed near each of our three principal towns, and allotted to a proportionate division of the county; and the little hamlets thus formed may be designated by some name denoting their object, as, for instance, "The Repose." These groups might be erected in succession, or simultaneously, as the means should be obtained; and the funds for each should be raised apart, in the division of the county to which it is to be attached, and

should also be managed separately from the others. The effect of this would be to form three distinct branch associations; but these, for the sake of greater dignity and stability, should be included under one general whole, and a joint report of the proceedings of all should be published annually. Such appear to me to be the brief essentials of a readily practicable scheme for a highly praiseworthy object. It would be easy for me to enter more minutely into details of constitution and management; but what I have said is sufficient for my purpose, and I know that there will be no lack of men able to direct the scheme with success, should they approve of its suggestion.

It is a true and a pleasing reflection that, in the divine economy of the world, the practice of any of the virtues usually brings with it a two-fold recompense: not only a moral gratification, which is the most certain to follow, and is not the least precious, but temporal advantages also, which, if not more valuable, are at least more apparent, and can be more exactly appreciated. As to the former, it may be safely stated, that he who believes there is no pleasure in an act of benevolence has never performed one. For the latter, it will suffice to remark, that a reward bestowed upon the faithfulness of the servant must react unfailingly upon the interests of the master, because the standard of duty will be generally raised to a still higer point than formerly, and the ardour to attain it will be more extensively diffused. The relations between master and servant will be thus more firmly and permanently established, and on purer and safer grounds. Over the prospects of the hind, hope will throw a gleam of light such as has rarely visited them before, and its cheering effects will shew themselves in still more zealous, upright, and enduring labours. Thus the advantages of superior virtue being distinctly marked, men will be incited by emulation and encouraged by example to strive earnestly to secure them; and, in this way, the benign influence, extending itself in gradually widening circles and through all classes, will imbue at last the whole social system, of which it may be said that the superstructure will stand the more securely erect that the basis has been prudently consolidated, and rendered proof against the corroding elements of envy and discontent. Woe to society, my Lord, when its various grades look more to their points of difference than to their points of union!

If I have formed a just estimate of the value of the scheme which I now propose, it would be insulting the judgment and impugning the liberality of the landlords and tenantry of the county to doubt either their willingness or their ability to carry it into effect. The project is not costly; for it is not our virtues, but our vices and vanities, that are expensive to us. I compute

that the number of hinds in the county who have passed the age of sixty years may be about 250, and of these not many, under the present system, have served a sufficient period with the same master to entitle them to be enrolled as claimants of the benefits of the association. Under these circumstances, it appears to me that an income of £300 a-year, which would warrant the association in placing at least fifteen annuitants on their roll, would be amply sufficient for the early purposes of the institution. Were this income to be levied on the whole annual value of the real property in the county, it would be at the rate of little more than a guinea on every thousand pounds. Were the whole of the landed proprietors, persons of independent fortune, and farmers, to join in the subscription, it would be only four shillings per annum from each individual. At so cheap a rate as this could honesty and virtue be fostered and rewarded, among those whose poverty surrounds them with temptations which the rich can never know. But, of course, all will not subscribe. There are some who turn from a generous action as from something revolting to their nature. Others there are who, without pretending to impugn the force of a single statement which has been advanced, will yet affect to receive all with cold mistrust, chiefly, it may be, because the scheme has not emanated at first from their own sagacity. Such individuals are likely to have malice to sneer in proportion to their want of liberality to approve and to support, and may, perhaps, willingly turn aside from the plan, to carp at the manner in which it has been advocated by its author. But these persons are beyond the limits of my address. I do not pretend to teach kindliness to the malevolent, generosity to the covetous, or foresight to the improvident. My appeal is to liberality, where I have reason to confide in its existence—my aim is to point out an object for its expenditure, which will no more diminish its ultimate resources than the seed sown in spring will lead to a diminution of the stores in autumn. I can scarcely bring myself to fear that my appeal will be in vain.

And now, my Lord, having directed your attention to these things, I willingly withdraw myself again under that veil of obscurity whioh belongs to my position, and which few will desire to penetrate. Mortem vitamque juxta æstumo: quoniam de utrâque siletur. Still, from the depths of that obscurity, I shall watch the progress of the scheme which I have suggested; happy, should it be matured under your auspices, that I have been for once instrumental, however feebly, in conferring a benefit on a deserving class of my fellow men, and not unhappy, should it fall neglected, to retain the reflection that I have at least attempted the pious duty. They are doubly blessed whom providence has endowed with the disposition as well as with the power to do

good. To the former I may aspire along with your Grace; for humanity ought to be the common characteristic of man: but to the latter I can proffer claims of the most humble description only. Yet I assure your Grace that, should you succeed, by your exertions and by your influence, in rearing these little Chelseas for our veterans of peace, I shall envy you even less your ducal possessions and dignity than the emotions with which you will look upon the peaceful roofs which you have erected as a last and well-earned shelter for honourable age when exhausted by its toils.

With every confidence in your Grace's kind consideration, I have the honour to be, &c. &c.

A. A.

THE FARMERS' NOTE-BOOK.—NO. VIII.

Ale and Beer. By James H. Fennell.—The Egyptians are said to have been the inventors of ale, their soil producing an abundance of corn.

In Great Britain, malt liquor was used as early as the fifth century, and considerable breweries existed in London before the Norman Conquest, supplying ales of different qualities and degrees of strength. Ale is mentioned in the laws of Ina, King of Wessex. It was the favourite drink of the Anglo-Saxons and Danes, as it was of their ancestors, the Germans. It very soon found a place at the table of royalty. We are told that it was one of the liquors provided at a banquet in the reign of Edward the Confessor. Chaucer, who lived in the reigns of Edward Third, Richard the Second, and Henry the Fourth, has celebrated the Southwark ale of those days as "the nappy strong ale of Southwark."

It is probable, however, that the drinking of beer was not a general custom in England until the reign of Henry the Seventh, in whose time the breweries, which then stood on the banks of the Thames, at St Catherine's, and distinguished in the map given in the "Civitates Orbis" by the name of beer houses, were twice "spoiled" by the king's officers, either for sending too great a quantity abroad unlicensed, or for brewing it too weak for home consumption. During the whole reign of Elizabeth the foreign demand for English beer continued to increase, and the liberty of export was only occasionally checked by the occurrence of scarcity or dearth at home. What we call beer is of later origin than ale. Thus sings the poet:—

"Ale for antiquity may plead and stand,
Before the conquest, conquering in this land;
Beere, that is younger brother of her age,
Was not then born, nor ripe to be her page."
(*The Philosopher's Banquet*, 1633.)

Taken regularly and moderately, ale is nourishing, wholesome, and conducive to longevity. The epitaph on Brawn, the famous Irish beggar, who died at a great age in Cornwall, is a testimony in favour of this beverage:—

"Here Brawn, the common beggar, lies,
Who counted by his tale,
Some six score winters and above—
Such virtue there's in ale.
Ale was his meat, his drink, his cloth,
Ale did his death reprieve;
And could he still have drank his ale,
He had been still alive."

Ale is highly extolled by Shakespeare in his plays. In the "Winter's Tale" (act iv. scene 2) he prompts Autolycus to say, "A quart of ale is a dish for a king;" and in his "Henry the Fifth" (act iii. scene 5) the constable of France, trying to account for the dauntless bravery of the English, asks if our "barley broth," as he is pleased to call ale, can "decoct" our "cold blood to such valiant heat." In "Henry the Eighth" (act v. scene 3) mention is made of "ale and cakes." Anthony à Wood tells us that when Prynne studied he seldom eat any dinner, but used every three hours to munch a roll of bread, and refresh his exhausted intellects with ale. Then his "ale washed wits" were ready for duty again. It was, no doubt, from its power to cheer up the sinking spirits, that, in ancient times, it was customary to present to malefactors, on their way to the gallows at St Giles', a great bowl of ale, their last draught in this world. A similar custom prevailed at York, and gave rise to the saying, that "the saddler of Bawtry was hanged for leaving his liquor;" for had he condescended to stop a while and drink up this last offering of ale, his reprieve, which was then on the road, would have arrived in time to have saved him.

Such are the great merits of ale, that Dr Westmacott could not avoid making a digression in praise of it even in his "Scripture Herball," (1695.) "Our old English ale," says he, "when without those vile commixtures and unwholesome additions which some use in order to increase its energy and for other compotating ends, is a most wholesome connatural drink. Beer (which only differs from ale by being well hopped for its purgation and preservation) was formerly more used by our old English gentry and housekeepers than in these days, being laid much aside, upon a vulgar and erroneous opinion that beer high-boiled with hops causeth stone and gout, which was an absurd mistake; for the temperate

use of it doth not so. He that in his young days accustometh himself to drink his ale, mixed or dashed with a little beer, shall never when he is old have occasion to repent; for beerish drink keeps the stomach clean, excites the appetite, and carries of ill-humours; whereas fat, new, ropy, sweet ale, (too often none of the clearest,) dulls the appetite, creates clams in the viscera, and lodges too long. For myself, ye may conclude that I am a toper at old beer, by my appearing such an advocate for it."

Every reader of romance knows that it was the custom of our Saxon ancestors to drink their ale out of skulls at their feasts. Such were the rude ale-bowls of antiquity. At Braintree and Bocking, in Essex, when topers partake of a pot of ale, the measure they have it in is a peg-tankard divided into three parts or draughts, the first of which is called *neckum*, the second *sinkum*, and the third *swankum*. For the origin of bottled ale, we suppose we must receive the quaint account given by Fuller in his "Worthies of Lancashire." He relates that the learned and pious Sir Henry Wotton, having one day left his usual piscatory companion, to wit, a bottle of ale, in the grass beside the river Thames, he found it some days after, when, lo and behold, it was "no bottle, but a gun, such the sound at the opening thereof." This anecdote reminds us of an Indian who, being at an Englishman's table at Surat, expressed his surprise, by loud exclamations, on seeing a vast quantity of froth ooze out of a bottle of porter as soon as the cork was drawn. Being asked what surprised him, he replied, "I don't wonder at all that the froth comes out of the bottle; but how the deuce did you ever contrive to squeeze it all in?"

For centuries past, *la bonne biere d'Angleterre* has been spoken of in raptures by Frenchmen, Belgians, Germans, and other people. When the Persian ambassador and his suite left England a few years since, many of them shed tears. One of them, struck with the quiet of an Englishman's life compared with that of a Persian, declared that he could not desire a better Paradise than Chelsea Hospital, where, for the rest of his life, he could wish to sit under the trees, and do nothing but drink as much porter as he liked. Madame Malibran, like many other foreign *artistes* of both sexes, preferred bottled porter to any other beverage. Her favourite repast, at the conclusion of an evening's arduous performance, consisted of oysters and bottled porter, 'yclept stout; not a very pernicious indulgence, but her fondness for it gave rise to a very ludicrous mistake on her part. Malibran hearing the name of the Honourable Craven Berkeley announced in company, exclaimed with great animation, as she seized his hand, "Ah, Mr Barclay and Perkins, I do owe you so moch!" The Berkeley family pronounce their name Barclay—hence poor Malibran's mistake.

The last time Madame Pasta was in England, a literary lady of high distinction asked her whether she drank as much porter as usual. "No, mia cara, prendo half and half adessa," she replied. At Munich beer is regarded by the king and his people as indispensable to the health and comfort of the entire community. Within the last few months that capital was the scene of a riot arising out of popular indignation against the brewers for raising the price of beer. If a Bavarian peasant is not at work he is sure to have a can in his hand. Beer is to him what it was to Boniface—meat, drink, sleep, and clothing; for, notwithstanding this penchant for beer, no signs of poverty are visible from one end of the Bavarian dominions to the other. Charles Lamb's fondness for children is still in the recollection of his admiring friends.

Hogarth's print of Beer Street has the following lines appended to it:—

"Beer, happy produce of our isle,
  Can sinewy strength impart,
And, wearied with fatigue and toil,
  Can cheer each manly heart.
Labour and art upheld by thee,
  Successfully advance,
We quaff the balmy juice with glee,
  And water leave to France.
Genius of health! thy grateful taste
  Rivals the cup of Jove,
And warms each English generous breast
  With liberty and love."

The celebrated Professor Liebig says that wine, spirits, and beer are *necessary* principles for the important process of respiration, and it would seem that the stomachs of all mankind, teatotallers included, will secrete these articles from the food which is eaten. We see frequently an interesting evidence of this fact in the case of a horse, after a feed of corn, resuming his journey with readiness and energy, although quite knocked up and out of breath a few minutes before. The simple fact is, that the horse converts the corn into beer, which facilitates his powers of respiration, and gives him fresh vivacity. If any man is resolved to carry out total abstinence strictly, he must refuse every sort of vegetable food, even bread itself; for all such diet contains more or less of alcohol. In the *Geographical Society's Journal* (vol. ii. p. 286) it is recorded that, during a severe winter on the west coast of Africa, the crew of the *Ætna* suffered so much from scurvy, that the least scratch had a tendency to become a dangerous wound. Captain Belcher states that "fish diet was found to aggravate the complaint; and it is worthy of remark that, when our ships used to suffer so much from scurvy, stockfish was a

portion of their allowance. The only thing which appeared materially to check the disease was beer made of the essence of malt and hops; and I feel satisfied that a general issue of this on the coast of Africa would be very salutary, and have the effect especially of keeping up the constitutions of men subjected to heavy labour in boats."

Liquid Manure Composts. By Mr GEO. WM. HAY, Whiterigg, Melrose.—Much has been said and written on the subject of liquid manure, and it is one to which we all pay far too little attention; for, in allowing it to escape from our cattle-folds in the first instance, we lose the very essence of our manures, and, in not providing ourselves with a tank, or other means of retaining it after its escape from these, we lose it altogether.

In Number VII. of the *Journal of Agriculture* for January 1845 there is an article on this head by Mr John Lawson, Elgin, giving us a method adopted by him for the application of the surplus urine of his cattle-folds.

I am at all times anxious and ready to try, not only everything by which there may be no waste of manure, but also any means by which I may be enabled to add to my stock of that very valuable article; but it appears to me that this method of Mr Lawson's, though it may suit farmers in his part of the country, will not at all suit those in our locality, (western district of Roxburgh,) where the lime has to be driven thirty miles, less or more, and where the price per ton is 15s. at the least; and the distance from any town where sulphuric acid can be got is thirty-six miles, and the price per lb. is 2d., besides carriage. I mean the best acid—for I am aware that it can be got cheaper. Besides, we have no lime-kilns whereon to burn the earth, and consequently would require to construct one, which of itself is a consideration. Then there is the carting of the earth to be burned, as well as the after-carting to the pit beside the tank where it is to be mixed, all of which things it is scarcely possible to expect a small farmer to do. There is also the raising of the wooden shed to be added to all this, which probably is the most impracticable part of the whole. Far be it from me to wish to detract, in the smallest degree, from the merit due to Mr Lawson for recording the practical results of his experience in this matter, and for his kindness in thus laying a means of supplying a great desideratum before his brother farmers, at the same time I am afraid that not only is the labour of his method too great, but that the cost will far exceed the profit, seeing that guano and other manures can be had so cheap.

Having taken it upon me to differ so far from Mr Lawson as regards the management of liquid manure, yet agreeing with him in the need there is for the husbanding of all our resources

—and that at the very cheapest rate—I may be allowed to give my own method of using it for the last two years.

I have no cattle-folds, but from the stable and byre, as also from the court into which the manure from these is wheeled, as well as from the water-closet in the house, the *liquid* manure is conveyed by means of drains to a large covered tank, from which it is pumped occasionally into a large barrel, and run out upon grass-land.

Beside the tank there is a pit dug, about a foot or eighteen inches deep, into which all the ashes from the house are put, together with the cleansings of the hen and pigeon houses, the floors of which are strewed often with sawdust—which can be obtained from sawyers, or a saw-mill, if there is one near, at a nominal price, if any—and this is done every week, or oftener if needful.

A large covered barrow, such as is used by scavengers in towns, (it is a square box placed upon a wheelbarrow frame, having a lid hinged in the centre, and movable at pleasure, to allow of its being emptied the more easily,) stands near the kitchen door, into which the ashes as brought from the grates are put. This I find by far the cleanest and simplest mode of retaining them for a time, as it gets quit of the filthy ash-pit so generally seen, and saves the usual cartage required, besides affording a ready means of transport to the pit.

When the ashes and cleansings from the houses are put into the pit, they are carefully mixed, and well watered with the liquid manure from the tank, either by means of a pitcher, or piece of pipe leading from the pump, as answers best at the time; and as a fresh supply of the several materials is brought, they are spread over the top of the last heap, and all turned over, and well watered.

Besides these several articles, there are two of great value, and which are too much lost sight of—nightsoil and blood. The former of these can be collected in considerable quantities about a farm, at very little trouble and expense. I have two houses on the premises, having boxes which slip out and in beneath the seat; these are regularly emptied into the pit among the ashes and turned over along with them. From the water-closet in the house a drain runs into a large barrel, sunk deep into the ground, puddled with clay outside, covered with a flat stone, and well cemented over with clay, and a thick coating of gravel over all; this is opened once a-year, and the contents carried to the pit. There is a drain from the upper part of this barrel which allows the liquid part to run off into the tank.

The blood, which is used in the same way, I obtain from a slaughter-house in the neighbouring village; this, however,

though it is of much consequence, cannot be obtained by farmers generally, and should not be taken into account.

In addition to the above, I may state that I have a supply of gas-water from a gas-work a few miles off—when the weather or other circumstances prevent its being run out upon the grass-land, the pit and its contents receive the benefit; this also must not be reckoned upon in general cases.

As I have touched upon gas-water, I may mention my method of using it, in case that way be different from what is practised by others.

The barrel made use of is one holding 120 gallons, 15 gallons of gas-water, previously mixed with sulphuric acid, at the rate of 4 ounces to the gallon, is put into the barrel, which is then filled up with water, making seven parts of water to one of gas-water, about the right proportion I think; this is then run out upon the young grass. An acre of land requires 14 of these barrels full, making in all 210 gallons of gas-water, and 52 lbs. of sulphuric acid. The expense of acid alone for this is about 8s. 8d., not taking into account at all the expense of gas-water, nor the far heavier one of filling the barrels and carting. This process does well enough for experiment, and is, I must say, highly beneficial, my grass being a splendid crop when it was cut: but it does not pay, nor can it be expected to do so; for unless the articles made use of be really at hand, it cannot be profitable to make such mixtures, and we had better, therefore, *buy* an article which we are sure will repay us.

With regard to the mixture thus obtained, the effects produced by it are felt not merely by the crop to which it is applied, but by the succeeding ones, as in the case of spring wheat this year after turnips. It was spread, not by the hand but by a shovel out of the cart, regularly over the open drills, and these being drilled up, Swedish turnip seed was sown, and a very heavy crop followed, superior to that raised on well-rotted stable-yard manure, the drills being contiguous. On their removal, spring wheat was sown, and after it brairded, and during its growth, a great difference was perceptible, for which we could not account at first, until it was remembered that the mixture had been sown on that part of the field. The young grass is also very good.

At present, although we have used a considerable quantity for the garden and other purposes, there are about six or eight cart-loads lying ready for use, and by turnip time there will be a good deal more; and if I, who have so few resources at hand, am able to raise twelve, fourteen, or even more cart-loads, what may not be done upon a farm of moderate size, where there are several cottages, and consequently a quantity of ashes, &c., besides what comes from the farm-house itself? A vast quantity of very valu-

able materials may thus be easily collected, at a cost which is neither known nor felt, for there is no actual outlay, and the time taken in removing to the pit and turning is only an hour or so once a-week.

I fear this has been drawn out to an unnecessary length, but should it be the means of inducing any reader of this Journal to be more saving than hitherto of his ashes and nightsoil, as well as of the recent guano of his hen-house, I trust I shall be excused.

*Boussingault's Economie Rurale—Translation of that Work by Mr Law.**—To all who feel an interest in agricultural chemistry—and this designation, we hope, may be regarded as including all who feel an interest in agriculture—the name of Boussingault is likely to have been, for some time, familiar. He has long been known as a skilful chemist; and as having employed his talents most successfully in elucidating many of the obscure points in practical husbandry. He has not, indeed, presented himself to the public in the same attitude which Liebig has assumed. He is not ambitious of being brilliant, attractive, or eloquent. He is not the champion, the paladin of the science. He pursues his career quietly and unobtrusively, but not, on that account, less usefully. He possesses, in an eminent degree, that patient and pains-taking industry which are so necessary in a case of this kind, and he never fails to inspire us with confidence in the result of his investigations. We feel that we are in safe hands. A work, therefore, embodying his chemical investigations into subjects more or less directly relating to agriculture, must necessarily be of great value. That such is the character of the *Economie Rurale*, is, we believe, generally admitted. It embraces most of the subjects in which agriculturists are interested, and treats of them in such a manner as to be highly instructive, not merely to the scientific inquirer, but to the practical husbandman; for M. Boussingault is not only a man of the highest scientific acquirements, the friend and fellow-labourer of such men as Arago, Biot, and Dumas, but he is also an experienced farmer, and has tested his theoretical opinions by actual practice. He has, therefore, been placed in the best possible position for engaging successfully in researches into the various branches of rural economy.

An English translation of the work, comprising the results of these researches, would obviously be of great utility to the

* "Rural Economy, in its relations with Chemistry, Physics, and Meteorology; or, An Application of the Principles of Chemistry and Physiology to the Details of Practical Farming." By J. B. Boussingault, Member of the Institute of France, &c. Translated, with an Introduction and Notes, by George Law, Agriculturist. London: H. Bailliere, 1845.

British husbandman. This task has been undertaken by Mr Law; but we regret to say that, either from incompetency or carelessness, or both these combined, it has been executed in such a manner that it can only be spoken of in terms of condemnation. Indeed we allude to the translation in question chiefly for the purpose of warning our readers against it. The errors in rendering the text are numerous and glaring; the most important statements of the author are misunderstood or perverted, and liberties are taken with the original which no translator has a right to venture upon. Professing, on the face of it, to be a translation of the entire work, we learn, on turning to the editor's introduction, that in a very few places he has ventured slightly to condense the style of the original, in order to keep the volume within moderate dimensions; and that, in other instances, he has made bold to retrench details, and give the results or conclusions only. Let us observe to what extent this has been carried, and we shall select our examples from a single chapter only. The third chapter of vol. i., on the important subject of vinous fermentation, extends, in the original, to forty pages; in the translation it occupies nine pages. The paragraph beginning on page 509 of the original, and occupying nearly two pages, is entirely omitted; page 512 is omitted; pages 514 and 515 are omitted; many lengthened paragraphs on wine are passed over; and the notice of the Mexican beverage named *pulque*, with which the chapter closes, and which in the original occupies two pages and a-half, is dismissed in the translation in four sentences. This is condensing the style and retrenching the details with a vengeance! But Mr Law does not merely condense and retrench—he likewise adds, amplifies, and improves on his author. The concluding part of the following sentence printed in italics has nothing corresponding to it in the original. "The reappearance of the milk, however, is not connected with the coming in of fresh provender, but with the return of plenty; *the animals are not only fed, from having been starved, but they are more than fed; they have something to spare which their economy turns partly into milk.*"—P. 612. In a paraphrase or commentary on the original, such amplifications as this—and similar examples are numerous throughout the work—would be in their proper place; in a professed translation, it is unnecessary to say, they are unwarrantable.

In order to justify the opinion we have expressed as to the inaccuracy of the translation, in regard to the mere rendering of the words and sense, it is necessary to cite a few examples:—Trs., p. 662, In the *lower* ranges of the Cordilleras.—Orig., p. 681, Dans les *hautes* Cordilières.—Tr., p. 79, The milk (of the Houra crepitans) had been sent to us *in guaduas*, by Dr Roulin.—Orig.,

p. 81, Le lait nous avait été envoyé *de Guaduas* (*i.e.*, from Guaduas, the name of a town,) par le Docteur Roulin.—Tr., p. 8, Buried branches acquire a fibrous *capillary* structure.—Orig., p. 15, Branches enfouies prennent une structure fibreuse, *chevelue*. The conversion of French weights and measures into corresponding English weights and measures is very commonly erroneous, in some instances egregiously so, as for example, at p. 508, where it is said that the loss of carbon amounts to 12¼ lbs., when, as in the original, it is stated at two kilogrammes, that is, about 4 lbs. 7 oz. Other errors of a similar kind, and equally important, occur on the same page. But it is needless to multiply examples. There is one particular we must not omit to mention, in which the translation is remarkable for its fidelity and close adherence to the original: all the typographical errors in the scientific names or otherwise are scrupulously retained.* We could the more readily have dispensed with this, as errors of the press are scattered over the pages of the translation with a profusion which we have seldom seen equalled in any modern publication.

Boussingault's first volume is occupied with the physical phenomena of vegetation, the chemical constitution of vegetables, vinous fermentation, and soils. These subjects are treated of in a very comprehensive manner, and much useful information is communicated in a condensed form, by means of carefully constructed tables. The second volume is likely to prove of most interest to the practical farmer. Manures of various kinds; rotation of crops; the feeding of animals belonging to a farm; their economy; and, finally, considerations of a meteorlogical nature on the subjects discussed. Had our space permitted, we should have been happy to give a few extracts from M. Boussingault's work, to shew of what valuable materials it is composed. We are not, however, without hopes that a translation will yet be laid before the farming interests of this country, published in a less expensive form, and doing justice to the original.

Rape and Stone or Stubble Turnip for use in Autumn.—The period of the year in which the stock-master perhaps experiences the greatest difficulty in maintaining the condition of his stock is from the early part of September, when the pastures begin to fail, to the early part of Otobeer, when the turnips are begun to

* The repetition of some of these errors is, obviously, the result of ignorance; others evince a degree of carelessness absolutely indecent and disrespectful towards the public. For example, in the body of the work, (we mean of the original work,) two successive chapters are respectively numbered IX. This error is carefully corrected by a note in the table of contents at the end of vol. ii. Disregarding this correction, the translation, in its table of contents, actually presents us with two consecutive chapters No. IX.

be consumed; and this difficulty is not so much felt in the mere inability to support the condition required by the stock during the summer, as in the injury inflicted from the want of sufficient food on the constitution of the animal, by a rapid falling off of its condition in the beginning of winter; for it is a fact which admits of no doubt, that, when an animal loses condition in autumn, the greater part of the succeeding winter passes away before it regains the point at which it began to fall off, whatever may have been the quantity, and however nutritious the food it may have received.

Cattle may have plenty of fresh air, and abundance of exercise in seeking a subsistence upon bare pasture, and though these are necessary means for maintaining good health, yet, when accompanied with exposure of the body to a cold atmosphere, in the latter end of autumn, and with a deficiency of food to generate animal heat to counteract the effects of the cold, they only aggrevate the evil, by wearing the flesh off the bones. And sheep may browse upon the tufts of grass left by cattle in summer, and nibble the points of the twigs of bushes, and thereby keep in life, but the astringent property of such food, immediately succeeding the effects produced by the succulent character of pasture grass, produces derangement of the digestive organs, which renders sheep easily susceptible of diseases incident to the vicissitudes of weather and of hunger.

It is a melancholy sight to observe creatures, which are only profitable in a high state of condition, allowed to wander over bare fields in autumn in quest of food, and thereby to eke out, day by day, a miserable existence. It has often excited our wonder, why people will attempt to keep stock when they know they have not the means of supporting them in condition from birth to maturity.

As long as that best of forage plants—the red clover—afforded two good cuttings in a season, the aftermath of the second cutting supplied as much pasturage as supported the stock in good condition to the beginning of winter, until, in fact, the turnips were ready for use; but since the land has evidently become tired of growing red clover so often, and a second cutting of it cannot be depended upon every season in the latter part of autumn, a period of a month's duration then not unfrequently occurs in which stock suffer from the pinching effects of hunger. Such an occurrence should, indeed, never happen on a well-regulated farm; for, since dependance cannot be placed on clover every year, a substitute should be cultivated, ready to be made use of whenever the clover is seen to fail; and, fortunately, there is more than one plant which comes to perfection at the very season when a scarcity in clover is most felt.

One of these autumnal substitutes is the *rape*, and it has the

accommodating property of growing well in any species of soil—whether clay, turnip land, or moss. Raised in the same manner as turnips, and at the same time, it will be ready for use by the beginning of September. No assurance of a full crop, however, can be expected but by means of manure, and both bone-dust and guano present ready means of securing such a crop. The rape imposes little trouble in cultivation during the summer, farther than to scuffle the ground to keep the weeds down at first, and the subsequent rapid growth of the crop will check the future progress of the weeds. The rape crop is not singled; and, on that account, the seed should be sown much thinner than with turnips, to allow the air to pass between the drills, in order to encourage the developement of the leaves, which are the useful part of the plant when cultivated for forage.

Inconvenience may be felt in sowing a large breadth of rape at once, and for this reason. By the time the entire crop is nearly eaten down, the stems become so strong as to be troublesome in disposing of them, when the land is about to be ploughed for the succeeding grain crop. Large stems of plants must either be pulled up, which is a laborious operation for even men to perform, and much more so for women, and carried off the land; or be ploughed down, and buried by the furrow-slice, on being placed in the plough furrrows with the small graip.

The only way of avoiding this inconvenience is fortunately a simple one, which is, to sow the entire space of ground to be occupied with rape at different times, so that the crop shall always be found in a young growing state, when the stock which subsists upon it arrives at it, and the stems then being always small and succulent, are either eaten entirely up, or the stems are easily buried with the plough.

It must be borne in mind, however, that rape is only suited for the support of sheep upon the land, and cannot conveniently be mown like clover with the scythe, or pulled like turnips for cattle. It is a fortunate circumstance, nevertheless, that so useful a forage plant as rape can be so easily raised for the use of sheep alone, and become available at the very season it is most desirable for that species of stock to have it. It has also proved itself a valuable preparation for ewes about to be put to the tup, by inducing that habit of body most favourable for the conception of twin lambs.

Besides rape, there is a species of turnip, bearing the appellation of the *stubble or stone turnip*, which is fit for use by cat le at the same season that rape is useful for sheep.

We believe this stubble turnip to be the ordinary white stone turnip of the gardens. It is not large, being about the size of a

small white globe turnip, and the largest specimen does not weigh more than seven pounds. The stem and leaves are small.

Mr Richard Makins of Shellacres, in Northumberland, was the first person we know who cultivated it in the field; and he informs us that it may be sown as late as the 1st of July, and yet be ready for use by the 1st September, that is, in only two months, though, of course, it will continue to grow after that period. Should it be desired to attain its full size by the 1st September, it should be sown earlier than July. Mr Makins sowed it as late as the 11th July last year, and had a good crop of it by September; but last year was a peculiarly favourable one for the growth of turnips. There would still be time to sow it this season after this notice of it shall have reached our readers.

It is apt to sport a flatness of top, which is an objection against it as a winter turnip, but which is one of the characteristics of the garden stone turnip.

It may be easily raised with bone-dust or guano, or a mixture of them with rape-cake. Being a fast grower, it cannot be expected to be very firm in the bulb, though that is both juicy and sweet.

It is consumed by being led out to the pasture fields to the cattle, or upon the stubble immediately after harvest. It has been so used in England for several years; and hence may have arisen its cognomen there of the *stubble* turnip.

We would remark, in conclusion, that when we possess the rape for sheep, and the stubble turnip for cattle, it will be the farmer's own fault should his stock want a sufficiency of food in autumn, before the period has arrived for hurdling the sheep on the land, or for housing the cattle in the steading for the winter.

AGRICULTURAL REPORT.

June 1845.

It is an old remark, that a late spring is a favourable one for Scotland. Vegetation is not then tempted to stir, before its proper time, by the alluring smiles of a deceitful February, and will not, therefore, be injured by the rough and cold blasts of March, or by the withering blights of May, fanned across the German ocean by an incessant east wind. When vegetation evinces no symptoms of life till May, it is capable, after so long a repose, of maintaining itself in vigour, even amidst adverse circumstances; and it can then pursue a successful career through the remainder of the season.

This season has afforded a striking example of a late and favourable spring. There was little appearance of vegetation in the fields and on the trees till far in May, and now, before June is ended, it has assumed a healthful vigour, which bids fair to support every species of crop to maturity.

The frequency of frost in winter, unattended with snow, rendered the soil

unusually tender and friable under the harrow, when the spring crops were sown. The frost, though alone, had no injurious effect upon the young wheat and clover plants in winter; for the small blanks observable among the winter wheat were probably occasioned more by the wire-worm than the frost; and, as to the clover plant, we have not had the satisfaction of observing such a flush of it as is now to be seen in the fields for several years past. Rain fell in due course after the seed-time, and promoted a full and healthy braird of all the spring crops. It also rendered the soil in the fittest state for the planting of potatoes, and the consequence has been, that that plant has sprung up equally and strong everywhere; for we have invariably observed that, when the soil is in a moist state at the time the potato is planted no failure occurs in the crop.

The moist weather was interrupted by intervals of drought, in which the friable land easily got quit of its weeds, and was prepared for the turnips in the most excellent order. Immediately thereafter, the rain again fell, and caused the brairding of the turnip seed in an unusually short time. During the moist and dry weather, the temperature was cold, accompanied with an east wind.

With a full plant of clover, and dropping showers, and lateness of the season, the hay crop will be very abundant; and its quality cannot fail to be fine, provided the crop shall have been industriously handled.

The same state of the weather has also been favourable to the pasture grass. Such of it as was early stocked with ewes and lambs became bare during the cold weather, but since the mildness of June, it has recovered itself, and is now in a very satisfactory state. We have no doubt the same result will occur in this as in former years, that whenever the weather becomes mild, immediately after new grass has been eaten down pretty close in spring, the grass will maintain much stock during the summer.

In regard to the present state of all the crops, namely, wheat, barley, oats, beans, tares, hay, grass, turnips, and potatoes, we have much gratification in expressing our opinion that, taking them relatively to one another, and comparatively with other seasons, we do not remember to have observed so uniformly a good crop, with so promising a result from it, for many years past. Their thickness in the ground, their vigour of growth, and their colour at this time, are all such as the most sanguine farmer could desire.

This opinion applies, however, more correctly to Scotland than to England, as in the latter country the crops are absolutely later than in the former, and, of course, will have shorter time to reach maturity in the ensuing autumn. The stock, too, in England will be placed this summer in a disadvantageous position compared with those of Scotland. The turnips there having failed last year, both the feeding and the store stock are lean. Feeding stock may return a profit when even fed expensively on oil cake, but the store stock ended the winter in very low condition; and, when turned out to the scanty pasture, in the end of April, they were literally reduced to a state of skin and bone. The greater part of the summer will elapse ere they can acquire a marketable condition. In Scotland, on the other hand, the turnips, and potatoes too, were so abundant, that they were not entirely consumed until June, by which time the grass was, of course, capable of affording the grazing stock a full bite, and of pushing them forward early to a high condition.

The lambing season was a very favourable one, both in the low country and amongst the hills, fewer casualties having happened to the lambs than for several years past, and they are now very equal and strong.

Sheep-shearing is in progress at present, and though we cannot state the actual result, we may anticipate that well-fed stock should yield a heavy and profitable fleece; and, for the reason already noticed, of the want of food in winter, we may expect the clip of wool in England to be comparatively light.

The price of stock of all kinds, and of butcher-meat, has risen to an unprecedented pitch—the best pieces of beef and mutton fetching, even in the wholesale markets, from 6s. 6d. to 8s. per stone imperial! Such prices have not been realized for many years. We anticipated as much in the beginning of winter, and predicted high profits to the breeders and feeders of stock in Scotland; and, in realization of those predictions, we have heard of L.9 a-head being gained on small cattle for their winter's keep, and of ordinary rough Leicester hoggs fetching 35s. a-piece.

This state of the meat markets should shew to Scottish farmers the insignificant effect which all their spare stock have upon the prices of the kingdom, that, in fact, it is the state of England that rules the destiny of the markets of Scotland. Let us see in what manner this is effected. The prospect of a want of winter food preventing the English dealers buying the usual number of stock at the Falkirk Trysts threw upon the hands of the Scottish feeders, last winter, more than their usual quantity of stock; and, notwithstanding of this, such was the excess in the crop of turnips and potatoes last year, that even the extraordinary number of stock could no more than consume the crop during a long feeding season. The quantity of fat meat must, therefore, have been very great this spring in the hands of feeders in Scotland, and the very tempting prices in England must have had the effect of sending thither a much larger quantity than usual. Yet with all this inordinate supply, raised under the most favourable circumstances, the price of meat is rather rising than falling in England; and this state of the market may be expected to continue during the summer, until what the state of the turnip crop next winter is likely to be shall be determined. The importation of foreign cattle has hitherto had no sensible effect on the markets, and, indeed, when the experience of this winter has taught us the lesson, that the largest supply Scotland can afford has not the slightest effect in depressing the prices, when there is a short supply of fat stock in England, it is highly improbable that any amount of importation from abroad can nearly equal the usual annual supply from Scotland. The present very high prices are tempting the Hamburgers to export cattle from Holstein, as also the Dutch. We shall see what quantities they can send during the course of the season. It will be a fact worth knowing to the consumers of good fresh meat, if a requisite quantity can really be obtained from those quarters in seasons of scarcity in this country, such as this happens to be.

The prices of grain remain as stationary as when we last remarked on the subject, four months ago, the highest aggregate average price of wheat in that time having been 46s. 2d., and the lowest 45s. 2d., making only a difference of 1s. a quarter in the course of four months, and in a period of the year, too, a little before harvest, when prices may have been expected to have risen. Should the present crop prove a prolific one—which God grant it may—though prices may fall, and there is not much room for a great fall—the growers will experience the gratification of having plenty amongst their hands to dispose of, and the consumers the satisfaction of having enough to eat, at a very moderate price; and in what better state should a people desire to be?

FOREIGN MARKETS, per Imperial Quarter, free on Board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1845.							
Feby.	Danzig.	28/ to 32/	20/ to 25/	10/ to 12/6	19/ to 22/6	23/6 to 27/	22/6 to 25/6
March.	..	28/6 33/	19/6 24/	10/6 13/	18/6 21/	24/ 28/6	23/6 27/
April.	..	29/6 34/	18/ 22/	10/ 12/6	17/6 20/6	27/ 30/6	24/ 28/
May.	..	28/ 32/6	17/ 20/	9/6 12/	20/6 25/6	24/ 32/	27/6 31/6
Feby.	Hamburg.	28/6 32/6	21/ 27/6	11/ 13/	19/ 22/6	25/ 28/	24/6 27/6
March.	..	26/ 29/6	22/6 27/6	12/6 13/6	20/6 23/6	22/6 27/6	23/ 26/
April.	..	28/ 31/3	19/6 24/6	11/6 13/	21/6 24/	23/9 27/6	22/ 26/6
May.	..	29/ 32/3	19/ 23/9	10/6 12/6	20/ 23/	24/6 26/6	21/6 25/
Feby.	Bremen.	34/ 37/6	20/ 25/6	11/6 13/6	18/6 22/	22/6 27/	24/ 28/
March.	..	34/6 38/	19/ 24/	11/9 14/	19/9 24/	23/6 28/6	25/ 29/6
April.	..	32/4 35/6	18/6 22/6	12/ 14/6	18/ 22/6	25/ 30/	24/6 29/
May.	..	31/ 34/9	18/ 21/	11/6 13/6	17/6 21/6	22/6 23/9	23/ 27/6
Feby.	Konigsburg.	30/ 34/6	18/ 20/6	11/ 13/6	19/ 22/	23/ 28/6	26/ 30/6
March.	..	32/ 36/	17/6 20/	11/6 14/	19/6 22/6	22/6 27/	25/6 29/3
April.	..	29/ 34/6	16/9 19/6	11/3 13/	19/3 23/	21/4 26/	25/ 30/
May.	..	28/ 33/	16/ 19/	11/ 12/6	18/9 22/6	20/6 26/6	25/4 30/6

Freight from 3/ to 4/ per Quarter to Great Britain.

TABL_ OF PRICES, &c.

Prices of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets:—

LONDON.

Barley.		Oats.		Rye.		Pease.		Beans.	
s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
35	0	22	4	31	4	35	6	34	6
34	5	22	1	31	2	35	2	34	1
33	2	22	4	30	6	35	3	34	2
33	1	22	6	31	4	35	7	35	5
33	2	22	4	30	8	35	8	34	6
33	0	22	2	31	4	35	6	33	0
33	0	21	6	30	10	34	8	33	1
32	5	21	11	30	6	34	10	32	7
33	7	21	10	29	9	35	2	33	9
32	11	21	3	30	2	35	8	32	8
33	8	20	5	30	10	36	4	33	6
32	3	21	1	31	4	36	8	33	2
30	8	21	2	31	8	37	2	34	9
30	10	21	4	30	10	37	6	35	2
29	10	21	6	30	6	38	0	35	10
30	1	21	11	30	4	37	8	35	10
24	6	22	0	30	2	37	2	35	0
25	6	22	4	30	6	30	8	34	9

EDINBURGH.

Date.		Wheat.		Barley.		Oats.		Pease.		Beans.	
1845.		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Feb.	5.	46	6	30	3	20	8	36	0	36	2
	12.	46	2	30	1	20	7	35	2	35	10
	19.	46	10	30	4	21	2	35	2	35	6
	26.	46	9	30	8	22	6	36	6	37	2
Mar.	5.	47	1	31	1	23	7	37	2	37	8
	12.	47	4	31	7	23	8	37	0	37	6
	19.	48	6	30	11	24	1	36	2	36	7
	26.	49	6	32	6	24	4	37	2	37	8
Apr.	2.	48	11	33	0	24	4	36	9	37	4
	9.	49	0	32	2	24	5	38	6	38	11
	16.	49	2	31	6	23	6	37	8	38	2
	23.	48	8	32	0	23	2	36	2	36	9
	30.	49	2	30	2	22	10	37	0	37	5
May	7.	48	10	32	3	22	9	36	6	37	0
	14.	47	9	30	10	22	5	37	0	37	7
	21.	47	11	31	1	22	0	36	6	37	0
	28.	49	6	29	11	23	3	36	4	36	11

LIVERPOOL.

	Barley.		Oats.		Rye.		Pease.		Beans.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
	33	8	21	9	32	2	35	10	39	1
	35	2	21	8	31	8	36	4	37	4
	31	10	21	1	31	6	36	2	36	10
	34	6	22	9	30	0	36	6	37	4
	35	1	21	8	30	6	36	4	36	6
	35	7	20	2	30	9	35	8	35	9
	30	6	21	8	30	8	35	5	33	11
	30	11	20	4	31	4	35	3	33	8
8	31	1	20	0	32	6	35	11	37	3
7	30	11	20	9	31	9	36	6	38	6
7	29	0	19	7	30	4	36	3	36	7
0	28	6	20	1	29	8	37	2	35	2
10	30	4	20	2	29	10	37	6	37	8
6	30	6	20	4	30	6	36	6	36	0
0	27	0	21	0	30	10	36	8	37	10
5	27	2	20	8	31	6	37	4	37	8
3	28	6	19	10	31	4	38	1	39	0
4	30	2	21	10	30	9	37	3	36	9

DUBLIN.

Date.		Wheat per Barrel 20 St.		Barley per Barrel 16 St.		Bere per Barrel 17 St.		Oats per Barrel 14 St.		Flour per Barrel 9 St.	
1845.		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Feb.	1.	26	0	16	0			11	6	15	11
	8.	25	3	15	8			11	2	15	9
	15.	25	7	15	5			11	1	15	7
	22.	24	6	15	1			10	11	15	3
Mar.	1.	24	5	15	8			11	0	15	3
	8.	23	6	16	0			11	2	15	1
	15.	25	0	15	11			11	0	15	0
	22.	24	6	15	10			11	3	15	2
	29.	24	10	16	0			11	5	15	3
Apr.	5.	24	11	15	6			11	4	15	2
	12.	24	8	15	2			11	6	15	0
	19.	23	9	15	0			11	6	15	2
	26.	24	3	15	5			12	0	15	0
May	3.	23	7	15	5			12	2	14	4
	10.	23	9	15	6			11	6	14	2
	17.	23	4	15	4			12	2	14	0
	24.	24	0	14	6			12	6	14	2
	31.	24	3	14	8			12	4	14	1

…wing the Weekly Average Prices of GRAIN, made up in terms of 7th and 8th Geo. IV., …d 5th Vict., c. 14, and the Aggregate Averages which regulate the Duties payable on …GN CORN: the Duties payable thereon, from February to June 1845.

Wheat.					Barley.						Oats.						Rye.						Pease.						Beans.					
	Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.		Weekly Average.		Aggregate Average.		Duty.	
d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
5	45	7	20	0	33	10	34	3	4	0	21	6	21	5	6	0	31	3	30	1	10	6	35	4	35	9	7	6	35	8	35	8	7	6
4	45	6	20	0	32	3	33	9	5	0	21	7	21	6	6	0	29	6	31	1	10	6	35	0	35	7	7	6	35	0	35	5	7	6
2	45	5	20	0	32	4	33	4	5	0	21	7	21	5	6	0	30	9	30	11	10	6	35	3	35	6	7	6	35	0	35	3	7	6
1	45	4	20	0	32	3	32	10	6	0	21	6	21	6	6	0	32	6	30	10	10	6	35	7	35	5	7	6	34	9	35	1	7	6
0	45	3	20	0	32	2	32	8	6	0	21	7	21	7	6	0	30	5	30	8	10	6	35	5	35	4	7	6	34	8	35	0	7	6
1	45	2	20	0	32	2	32	4	6	0	21	4	21	6	6	0	31	1	30	8	10	6	35	6	35	5	7	6	34	7	34	10	8	6
5	45	2	20	0	32	4	32	3	6	0	21	8	21	7	6	0	30	5	30	6	10	6	35	9	35	6	7	6	34	6	34	9	8	6
6	46	3	21	0	33	3	32	9	6	0	21	8	21	5	6	0	30	4	30	7	10	6	35	8	35	5	7	6	34	8	34	10	8	6
10	45	4	20	0	32	4	32	3	6	0	21	5	21	6	6	0	30	0	30	9	10	6	35	8	35	4	7	6	34	8	34	9	8	6
0	45	5	20	0	32	5	32	4	6	0	21	4	21	6	6	0	29	6	30	8	10	6	35	7	35	5		6	35	0	34	0	8	6
3	45	8	21	0	32	5	32	4	6	0	20	9	21	4	6	0	29	8	30	4	10	6	36	6	35	7		6	35	5	34	10	8	6
11	45	10	20	0	31	11	32	8	6	0	21	4	21	6	6	0	32	1	30	7	10	6	36	1	35	8		6	35	1	34	11	8	6
0	46	1	20	0	31	2	31	11	7	0	21	6	21	4	6	0	29	9	30	4	10	6	36	10	35	11		6	36	1	35	4	7	6
1	46	2	20	0	31	4	31	10	7	0	21	4	21	2	6	0	29	10	30	6	10	6	36	8	35	10		6	36	2	35	0	7	6
10	46	1	20	0	30	5	31	7	7	0	21	6	21	2	6	0	31	4	30	7	10	6	36	3	36	3		6	37	1	35	2	7	6
9	45	11	20	0	31	0	31	3	7	0	21	9	21	3	6	0	29	7	30	6	10	6	37	0	36	6	6	6	37	3	36	1	6	6
8	45	10	20	0	30	1	30	10	8	0	21	11	21	6	6	0	31	0	30	8	10	6	37	4	36	8	6	6	37	5	36	5	6	6
3	45	11	20	0	29	5	30	5	8	0	22	5	21	3	6	0	30	1	30	4	10	6	36	7	36	9	6	6	37	2	36	10	6	6

The MONTHLY RETURNS, published in terms of 9th Geo. IV. c. 60, shewing the Quantities of Corn, Grain, Meal, and Flour imported into the United Kingdom in each Month; the Quantities upon which duties have been paid for home-consumption, during the same Month; and the Quantities remaining in Warehouse at the close thereof, from 5th February to 5th May 1845.

Month ending	IMPORTED. From Foreign Countries.	IMPORTED. From British Possessions.	IMPORTED. Total.	CHARGED WITH DUTY. From Foreign Countries.	CHARGED WITH DUTY. From British Possessions.	CHARGED WITH DUTY. Total.	REMAINING IN WAREHOUSE. From Foreign Countries.	REMAINING IN WAREHOUSE. From British Possessions.	REMAINING IN WAREHOUSE. Total.
Feb. 5, 1845.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs.
Wheat, .	2,105 5	1,344 3	3,450 0	16,567 4	2,257 4	18,825 0	344,576 4	92 3	344,6[illegible]
Barley, .	28,639 2	29 3	28,668 5	25,754 5	29 3	25,784 0	8,141 2	. .	8,14[illegible]
Oats, . .	1,600 4	101 2	1,701 6	6,462 2	101 6	6,564 0	65,981 5	. .	65,9[illegible]
Rye, . . .	. .	. .	. .	2 7	. .	2 7	2 6	. .	[illegible]
Pease, .	316 1	1,079 6	1,395 7	1,898 4	1,079 6	2,978 2	6,312 1	. .	6,31[illegible]
Beans, .	11,983 2	. .	11,983 2	23,813 5	. .	23,813 5	2,786 7	. .	2,7[illegible]
Totals,	44,644 6	2,554 6	47,199 4	74,519 3	3,468 3	77,987 6	427,801 1	92 3	427,8[illegible]
Mar. 5, 1845.									
Wheat, .	4,629 5	1,698 2	6,327 7	13,831 6	1,028 4	14,860 2	330,382 2	751 3	331,13[illegible]
Barley, .	27,807 3	. .	27,807 3	35,241 4	. .	35,241 4	1,136 4	. .	1,13[illegible]
Oats, . .	2,573 4	. .	2,573 4	4,901 3	. .	4,901 3	62,375 3	. .	62,3[illegible]
Rye, . .	. .	. .	. .	. .	. .	. .	7 5	. .	[illegible]
Pease, . .	1,345 5	8 4	1,354 1	1,408 2	8 4	1,416 6	6,024 2	. .	6,02[illegible]
Beans, . .	4,651 6	. .	4,651 6	2,104 4	. .	2,104 4	5,308 6	. .	5,30[illegible]
Totals,	41,007 7	1,706 6	42,714 5	57,487 3	1,037 0	58,524 3	405,234 6	751 3	405,98[illegible]
Apr. 5, 1845.									
Wheat, .	3,683 4	37 4	3,721 0	13,017 6	21 4	13,039 2	310,258 2	767 4	311,02[illegible]
Barley, .	8,415 2	. .	8,415 2	7,888 2	. .	7,888 2	1,645 1	. .	1,64[illegible]
Oats, . .	1,496 3	. .	1,496 3	3,704 3	. .	3,704 3	59,266 3	. .	59,2[illegible]
Rye, . .	. .	. .	. .	. .	. .	. .	7 5	. .	[illegible]
Pease, .	298 6	. .	298 6	444 5	. .	444 5	4,770 4	. .	4,77[illegible]
Beans, .	12,972 1	. .	12,972 1	5,636 4	. .	5,636 4	12,414 2	. .	12,44[illegible]
Totals,	26,866 0	37 4	26,903 4	30,691 4	21 4	30,713 0	388,392 1	767 4	369,15[illegible]
May 5, 1845.									
Wheat, .	2,129 3	88 4	2,217 7	6,425 6	53 4	6,479 2	297,525 3	802 4	298,32[illegible]
Barley, .	35,567 1	. .	35,567 1	30,276 2	. .	30,276 2	6,691 2	. .	6,69[illegible]
Oats, . .	42,443 4	. .	42,443 4	39,730 3	. .	39,730 3	58,752 6	. .	58,75[illegible]
Rye, . .	295 6	. .	295 6	10 2	. .	10 2	294 1	. .	29[illegible]
Pease, . .	2,046 2	. .	2,046 2	1,720 5	. .	1,720 5	5,068 7	. .	5,5[illegible]
Beans, .	6,918 3	. .	6,918 3	1,846 7	. .	1,846 7	16,809 5	. .	16,8[illegible]
Totals,	89,400 3	88 4	89,488 7	80,010 1	53 4	80,063 5	385,662 0	802 4	386,4[illegible]
Feb. 5, 1845.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. [illegible]
Flour, .	964 1 17	10,533 3 12	11,498 1 1	869 3 16	6,884 1 24	7,754 1 12	251,715 2 18	14,252 2 10	265,9[illegible]
Oatmeal,	13 2 16	1 1 11	14 3 27	. .	1 1 11	1 1 11	124 2 12	2 2 16	127
Totals,	978 0 5	10,535 0 23	11,513 1 0	869 3 16	6,885 3 7	7,750 2 23	251,840 1 2	14,255 0 26	266,0[illegible]
Mar. 5, 1845.									
Flour, . .	1,053 3 5	257 2 18	1,311 1 23	585 1 16	3,059 2 8	3,644 3 24	245,958 1 5	11,413 2 9	257,371
Oatmeal,	12 2 9	47 3 8	60 1 17	12 2 9	47 3 8	60 1 17	104 3 9	2 2 11	106
Totals,	1,066 1 14	305 1 26	1,371 3 12	597 3 25	3,106 1 16	3,705 1 11	246,063 0 14	11,416 0 20	257,478
Apr. 5, 1845.									
Flour, . .	84 3 16	6 2 8	91 1 24	320 1 18	4,707 1 4	5,027 2 22	236,839 3 8	6,712 2 11	243,552
Oatmeal,	3 1 24	. .	3 1 24	2 2 12	. .	2 2 12	84 1 18	2 2 12	87
Totals,	88 1 12	6 2 8	94 3 20	323 0 2	4,707 1 4	5,030 1 6	236,924 0 26	6,715 0 26	243,639
May 5, 1845.									
Flour, . .	1,437 2 16	1,301 2 4	2,739 0 20	136 3 18	2,830 2 2	2,967 1 20	233,653 3 4	5,117 1 18	238,771
Oatmeal,	76 1 12	. .	76 1 12	. .	. .	. .	160 2 8	2 2 12	163
Totals,	1,514 0 0	1,301 2 4	2,815 2 4	136 3 18	2,830 2 2	2,967 1 20	233,814 1 12	5,120 0 2	238,934

PRICES of BUTCHER-MEAT.

Date.	LONDON, Per Stone of 14 lb. Beef.	LONDON, Mutton.	LIVERPOOL, Per Stone of 14 lb. Beef.	LIVERPOOL, Mutton.	MORPETH, Per Stone of 14 lb. Beef.	MORPETH, Mutton.	EDINBURGH, Per Stone of 14 lb. Beef.	EDINBURGH, Mutton.	GLASGOW, Per Stone of 14 lb. Beef.	GLASGOW, Mutton.
1845.										
Feb.	5/6 to 7/9	5/6 to 7/9	5/6 to 7/3	5/3 to 7/3	5/6 to 7/3	5/6 to 7/6	5/3 to 7/	5/ to 7/	5/3 to 7/3	4/3 to [illegible]
March	5/6 7/6	5/3 7/6	5/6 7/3	5/3 7/6	5/6 7/6	5/6 7/6	5/3 7/	5/3 7/	5/3 7/6	[illegible]/3
April	5/9 7/9	5/6 7/9	5/6 7/6	5/6 7/6	5/9 7/9	5/9 7/9	5/6 7/3	5/6 7/3	5/6 7/6	5/6 [illegible]
May	6/ 8/	6/ 8/	5/9 7/9	5/9 7/9	5/9 8/	5/9 8/	5/9 7/6	5/9 7/6	5/9 7/9	5/6 [illegible]

PRICES of English and Scotch WOOL.

English, per 14 lb.			Scotch, per 14 lb.		
Merino,	14/6 to	2/6	Leciester Hogg,	16/6 to	21/
in grease,	14/	17/6	Ewe and Hogg,	13/	11/6
South Down,	17/6	21/6	Cheviot, white,	12/	14/6
Half Bred,	14/	17	Laid, washed,	9/	12/
Leicester Hogg,	16/6	21/6	unwashed,	7/	10/
Ewe and Hogg,	13/	16/	Moor, white,	6/	8/6
Locks,	7/6	10/6	Laid, washed,	4/	7/
Moor,	6/6	8/6	unwashed,	4/6	6/

THE REVENUE.

***ABSTRACT** of the Nett Produce of the Revenue of Great Britain, in the Quarters and Years ended on the 5th of April 1844 and 5th of April 1845—shewing the Increase and Decrease on each head thereof.*

	Quarters ending April, 5.		Increase.	Decrease.	Years ending April, 5.		Increase.	Decrease.
	1844.	1845.			1844.	1845.		
	L.	L.	L.	L.	L.	L.	L.	L.
Customs, ...	4,604,447	4,402,506	. .	201,941	19,458,129	20,176,731	718,602	. .
Excise, ...	1,852,689	1,917,485	64,796	. .	11,880,123	12,224,907	344,784	. .
Stamps, ...	1,639,011	1,742,161	103,450	. .	6,472,018	6,714,818	242,800	. .
Taxes, ...	144,665	145,945	1,280	. .	4,192,473	4,217,748	25,275	. .
Post-Office, . .	174,000	178,000	4,000	. .	622,000	679,000	57,000	. .
Miscellaneous, .	41,292	415,016	373,724	. .	1,281,977	1,192,354	. .	89,623
Property Tax, .	1,992,859	1,905,711	. .	87,148	5,356,857	5,104,418	. .	252,439
	10,440,163	10,707,124	547,230	289,089	49,263,637	50,309,998	1,388,461	342,062
	Deduct Decrease,		289,089		Deduct Decrease,		342,062	
	Increase on the Qr.		258,141		Increase on the Year.		1,046,399	

FIARS PRICES of the different COUNTIES of SCOTLAND, for Crop and Year 1844, by the Imperial Measure.

ABERDEENSHIRE.

	Imp. qr.
Wheat, without fodder, .	
—— with fodder, ...	
Barley, without fodder, . . .	27/3
—— with fodder, ...	33/
Bear without fodder, . . .	25/3
—— with fodder, ...	31/
Oats, Potato, without fod.,	18/3
—— —— with fodder,	24/
—— Corn, without fod., .	17/3
—— —— with fodder,	23/
Pease, ...	
Beans, ...	
Malt, duty included, ...	49/6
Oatmeal, 140 lb.	14/4

ARGYLE.

Wheat, ...	45/6
Barley, ...	30/8
Bear, ...	29/4
Oats, ...	18/10
Beans, ...	39/4
Oatmeal, per 140 lbs.	15/2

AYR.

Wheat, ...	43/9½
Barley, ...	29/5
Bear, ...	25/11½
Oats, White, ...	16/9¾
Pease and Beans, ...	36/6½
Oatmeal, per 140 lb.	14/8¾

BANFF.

Wheat, ...	42/3
Barley, without fodder, . . .	27/
—— with fodder, ...	31/
Bear, First, without fodder,	24/
—— —— with fodder, .	28/
—— Second, without fod.,	21/9
—— —— with fodder,	25/9
Oats, Potato, without fod.,	20/
—— —— with fodder,	23/
—— Common, without fod.,	19/6
—— —— with fodder,	23/6
Pease, ...	
Beans, ...	29/8
Oatmeal, per 140 lb	14/2

BERWICK.

	Imp. qr.
Wheat, ...	42/0 11/12
Barley, Merse, ...	27/7 4/12
—— Lammermuir, . .	25/8 8/12
Oats, Merse, ...	20/1 3/12
—— Lammermuir, . .	19/7 3/12
Pease, ...	32/6 4/12
Oatmeal, per 14 lb . . .	1/5 10/12

BUTE.

Wheat, ...	
Barley, ...	
Bear, ...	
Oats, ...	
Pease, ...	
Beans, ...	
Oatmeal, per 140 lb . . .	

CAITHNESS.

Bear, ...	19/1
Oats, Hopeton, ...	16/
—— Sandy, ...	17/1
—— Angus, ...	17/1
—— Dun, ...	15/11
—— Black, ...	12/4
Oatmeal, per 140 lb	14/5

CLACKMANNAN.

Wheat, ...	42/5½
Barley, Kerse, ...	29/1¾
—— Dryfield, ...	28/1¼
Oats, Kerse, ...	20/0½
—— Dryfield, ...	19/5½
Pease and Beans, ...	36/4½
Malt, ...	50/11
Oatmeal, per 140 lb	15/10¾

DUMBARTON.

Wheat, ...	45/5
Barley, ...	28/9
Bear, ...	28/
Oats, ...	21/
Pease and Beans, ...	39/10
Oatmeal, per 140 lb	15/8

DUMFRIES.

	Imp. qr.
Wheat, ...	48/
Barley, ...	29/4
Bear, ...	28/4
Oats, Potato, ...	18/6
—— Common, ...	18/
Pease, ...	33/4
Beans, ...	36/10
Malt, ...	64/
Oatmeal, per 14 lb . . .	1/4½

EDINBURGH.

Wheat, First, ...	43/4
—— Second, ...	40/
Barley, First, ...	30/
—— Second, ...	27/6
—— Third, ...	26/
Oats, First, ...	21/8
—— Second, ...	19/
Pease and Beans, ...	35/8
Oatmeal, per 112 lb	12/9½
Load, 280 lb.	32/

ELGIN & MORAY.

Wheat, ...	41/3
Barley, ...	28/
Oats, ...	19/2½
Rye, ...	32/6½
Pease and Beans, ...	35/0½
Oatmeal, per 112 lb . . .	12/2

FIFE.

Wheat, White, ...	40/10½
—— Red, ...	38/10¼
Barley, ...	27/5½
Bear, ...	25/5½
Oats, ...	19/5½
Pease and Beans, ...	31/10
Rye, ...	26/11½
Malt, ...	43/9½
Oatmeal, per 280 lb . . .	29/11¼

FORFAR.

Wheat, ...	42/
Barley, ...	26/5
Bear, ...	24/8

FORFAR (*Continued.*)

	Imp. qr.
Oats, Potato,	19/10
—— Common,	19/7
Pease and Beans,	31/6
Rye,	24/2
Oatmeal, per 140 lb.	14/8

HADDINGTON.

Wheat, First,	48/9
—— Second,	46/5½
—— Third,	44/3½
Barley, First,	34/7½
—— Second,	32/7½
—— Third,	29/7½
Oats, First,	2[illegible]/3½
—— Second,	22/1½
—— Third,	21/0¾
Pease and Beans, First,	
Second,	
Third,	

INVERNESS.

Wheat, without fodder,	42/2
—— with fodder,	49/2
Barley, without fodder,	26/6
with fodder,	32/
Bear,	25/6
—— with fodder,	31/
Oats, potato, without fodder,	19/6
—— with fodder,	26/
—— Common,	
—— with fodder,	
—— Black,	
Oatmeal, per 112 lb	13/2

KINCARDINE.

Wheat, without fodder,	41/4¾
—— with fodder,	5[illegible]/6
Barley, without fodder,	25/9¾
with fodder,	32/11
Bear, without fodder,	23/10¾
—— with fodder,	31/
Oats, Potato, without fod.	19/6
with fodder,	27/6
White, without fod.,	18/5½
— with fodder,	26/6
Pease, without fodder,	29/4
—— with fodder,	38/6
Beans, without fodder,	30/10
—— with fodder,	41/
Oatmeal, per 140 lb	14/0¾

KINROSS.

Wheat,	36/1
Barley, First,	28/8
—— Second,	25/6
Bear, First,	
—— Second,	
Oats, White, First,	19/10
—— Second,	17/10
—— Black, First,	
—— Second,	
Pease, and Beans,	29/
Malt,	56/
Oatmeal per 280 lb	29/7½

KIRKCUDBRIGHT.

Wheat,	46/
Barley,	30/4
Oats, Potato, and Hop,	18/8
—— Common,	17/2
Oatmeal, per 14 lb	1/4½

LANARK.

	Imp. qr.
Wheat, First.	46/4½
Barley, First,	29/8½
—— Second,	28/2
Bear, First,	26/8½
—— Second,	23/8
Oats, First,	19/4
—— Second,	17/8
Pease,	31/8
Beans,	39/6
Malt,	52/4
Oatmeal, per 140 lb	1/[illegible]½

ARCHBISHOPRIC OF GLASGOW.

Barley,	
Oats,	
Malt,	
Oatmeal, per 110 lb	

LINLITHGOW.

Wheat,	42/6
Barley,	29/2
Oats,	19/8
Pease,	35/4
Malt,	50/10
Oatmeal, per 112 lbs.	12/3¼
—— 140 lbs.	15/3

NAIRN.

Wheat,	42/6
Barley, without fodder,	27/
—— with fodder.	32/
Oats, without fodder,	18/6
—— with fodder,	26/6
Oatmeal, per 112 lb	11/6

ORKNEY.

Bear, per 336 lb,	14/
Malt, 140 lb without duty,	15/7
—— with duty,	2[illegible]/10
Otameal, per 140 lb	11/4

PEEBLES.

Wheat, First,	41/7½
—— Second,	42/6½
—— Third,	41/1
Barley, First,	28/4½
—— Second,	27/1½
—— Third,	2[illegible]/
Oats, First,	19/1½
—— Second,	18/2½
—— Third,	16/9½
Pease, First,	35/1½
—— Second,	33/1
—— Third,	29/10¼
Oatmeal, First, per 140 lb	15/0½
—— Second,	14/9½
—— Third,	14/4½

PERTHSHIRE.

Wheat, First,	43/7
—— Second,	36/1
Barley, First,	27/
—— Second,	21/3
Oats, First,	19/
—— Second,	16/2
Rye,	30/2
Pease and Beans,	31/
Oatmeal, per 140 lb	14/3

RENFREW.

	Imp. qr.
Wheat, First,	44/6¾
—— Second,	44/1¾
Barley, First,	29/5
—— Second,	27/7¾
Bear, First,	26/5¾
—— Second,	21/5¾
Oats, First,	20/1
—— Second,	19/1
Beans, First,	42/
—— Second,	35/3
Oatmeal, per 140 lb	15/4¾
—— Second,	15/2¾

ROSS AND CROMARTY.

Wheat, First,	40/1
—— Second	35/8¾
Barley,	26/4¾
Bear,	22/
Oats, First,	19/6
—— Second,	28/6
Pease and Beans,	34/
Oatmeal, per 110 lb	14/2

ROXBURGH.

Wheat,	42/11[illegible]
Barley,	27/9[illegible]
Oats,	19/1
Pease,	33/6[illegible]
Beans,	32/6[illegible]
Oatmeal, per 140 lb	14/2

SELKIRK.

Wheat,	41/6
Barley,	26/6
Oats, Potato,	19/
—— Common,	17/9
Pease and Beans,	34/3
Oatmeal, per 280 lb	29/6

STIRLING.

Wheat,	38/8
Barley, Kerse,	28/8
—— Dryfield,	28/
Oats, Kerse,	19/1½
—— Dryfield,	19/1½
—— Muirland,	16/4
Pease and Beans,	36/4
Malt,	51/8
Oatmeal, per 140 lb	14/10½

SUTHERLAND.

Wheat,	46/
Barley,	28/6
Bear,	
Oats, Potato,	
—— Common,	20/3
Pease,	31/6
Rye,	
Oatmeal, per 140 lb	16/

WIGTON.

Wheat,	43/4
Barley,	29/10
Bear,	21/4
Oats, Potato,	18/4
—— Common,	16/8
Malt,	62/4
Pease,	
Beans,	32/8
Rye,	25/4
Oatmeal, per 280 lb	27/9

We may inform our English readers, that Fiar Prices are the average prices of grain, as ascertained every year by the verdict of Juries in every county of Scotland. These Juries are summoned in spring, and ascertain, from the evidence produced to them, the average prices of the preceding crop. By these prices, rents payable in grain, and similar contracts, are generally determined; but the main object is to convert into money the stipends (for the most part fixed at a certain quantity of grain) of the Scottish Clergy.

ON THE SOURCE OF THE CARBON AND NITROGEN IN PLANTS, AS DERIVED FROM THE SOIL.

By P. F. H. Fromberg, First Assistant in the Laboratory of the Agricultural Chemistry Association of Scotland.

Having lately seen the results and opinions on the action of humus and the origin of ammonia in the soil, which have been obtained and stated by my friend and teacher, the celebrated chemist and physiologist, Professor Mulder of Utrecht, called in question in a recent periodical, (*the Agricultural Magazine*, April, 1845,) and supposing that some to whom Mulder's name and book (*the Chemistry of Vegetable and Animal Physiology*) are not so well known as they ought to be, may be persuaded by these remarks that Mulder is not worthy of entire credit, I have thought it my duty, not only as Mulder's pupil and translator, but also for the sake of true science, to make a few observations, with the view of fairly representing his experiments, as contained in his memoir, entitled, "On the Condensation of the Nitrogen of the Atmosphere in the Soil, and on the Nutritive Properties of the Organic Constituents of the Soil for Plants."

The opinions of Mulder which have been impugned are,

1*st*, That the several organic constituents of the soil, namely, the humic, ulmic, geic, crenic, and apocrenic acids, after being combined with ammonia, are, as such, taken up by the roots and assimilated by plants, on the ground that the compounds which these acids form with ammonia are so very readily soluble in water, and because these several acids possess polybasic properties, by which they are enabled to form combinations with potash or soda, ammonia, lime, magnesia, and oxide of iron, in which several of these bases are present at one and the same time.

2*d*, That ammonia is formed in the soil by the combination of the nitrogen of the atmosphere with hydrogen in the nascent state, as liberated during the decay of vegetable and animal substances in the soil.

These opinions Mulder has, I think very fairly, derived from a number of experiments of great value and originality.

The objections stated in the periodical above alluded to are, that these experiments were partly unfair and in part were wrongly interpreted, and that Mulder's opinion in regard to humus is incorrect, inasmuch as the excretions from diseased elms consist of humus, it being, according to Liebig, absurd to suppose that a diseased plant could form the substance to which its health and vigour are to be ascribed; and, further, because charcoal has been discovered to increase the growth and heighten the colour of plants. Several other arguments are also adduced, which, however, like

those advanced for Liebig's theory concerning the origin of ammonia in the soil, I shall here pass unnoticed, as being almost entirely speculative. The only one which deserves more attention, and which I shall afterwards have occasion to refer to, is that which refers to the inert or indifferent properties of nitrogen, from which a direct union with hydrogen would appear to be impossible.

It will, therefore, be my first object to shew that Mulder's experiments are neither unfair nor their results incorrectly interpreted.

I. Of his experiments upon humic acid I may be permitted here to give a full account, which has not been done in any other than the original language. I may mention, beforehand, that I had an opportunity of personally inspecting the progress of the experiments to which I shall refer.

Mulder selected an apartment perfectly free from exhalations. In it he placed, close to one another, several glass vessels of equal size. These vessels were divided into sets, (each set being composed of five vessels,) and contained different substances, as mentioned below. In each set he placed the seeds of five different plants, namely, *a*, brown beans; *b*, white beans; *c*, garden peas; *d*, barley; *e*, oats. They were kept moist with distilled water. The experiments continued from the 16th of May till the 16th of June 1843, and the results were as follows :—

Components.	Results.
Set 1. Containing coarse sand, thoroughly washed with distilled water.	Very imperfect—the plants were scarcely four inches long, and almost all withered.
" 2. Coarse sand, mixed with one per cent. of wood ashes.	*a* Did not grow—*b* very weakly—*c* tolerably well—*d* very imperfectly—*e* a little better.
" 3. Coarse sand, ashes, and ulmic acid from sugar.	*a* Imperfectly—*b* tolerably well—*c* very well—*d* not at all—*e* very well.
" 4. Coarse sand, ashes, and apocrenate of ammonia.	*a*, *b*, *c*, and *d*, did not grow—*e* very weakly.
" 5. Sand, ashes, and humate of ammonia from garden mould.	None of the seeds grew ?
" 6. Sand, ashes, and humic acid from garden mould.	*a* Very luxuriantly—*b* not at all—*c* imperfectly—*d* not at all—*e* tolerably well.
" 7. Sand, ashes, and aqueous extract of humus, *i.e.* mould boiled out with water, and the solution concentrated by evaporation.	Only *d* grew up, though weakly.
" 8. Sand, ashes, and ulmate of ammonia from sugar.	*a*, *b*, *c*, and *e* most beautifully—*d* imperfectly.
" 9. Sand, ashes, and humate of ammonia from peat.	*a*, *b*, *c*, and *e* equally beautiful—*d* not at all.
" 10. A quantity of common soil.	Exactly the same results as in No. 9.
" 11. A mixture of charcoal, first heated to redness, and then cooled in a closed vessel, with wood ashes.	All succeeded, but were far inferior to the plants grown in the three last experiments.

From these accurately conducted experiments Mulder draws the following conclusions :—

1. That rain-water and atmospheric air are insufficient to support the life of plants.

2. That rain-water, wood-ashes, and air, are equally insufficient.

3. That the aqueous extract of humus contains too small a proportion of organic matter, to afford to plants all that they require.

4. That ulmic acid from sugar, though devoid of nitrogen, is really advantageous to the growth of plants.

5. That humic acid from garden mould is very useful in vegetation.

6. That humate of ammonia, from peat, is advantageous to the growth of plants.

7. That charcoal and ashes are inferior to arable soil, or to the substances mentioned in 5 and 6.

I may remark that the same substances often acted differently upon different plants, as might have been anticipated ; and this is possibly one of the reasons why different experimenters have obtained different results and have come to different conclusions.

But what I would now more especially allude to is the assertion that, in the experiments (8 and 9) in which humate and ulmate of ammonia were used, the plants grew so well, *on account of the ammonia*, and that the experiments conducted with sand and ashes were not fair, inasmuch as this was not a fair condition for plants to grow in.

Now, I would ask, if the plants grew there on account of the ammonia, why Nos. 4 and 5 failed, and why No. 10, though the materials contained very little ammonia, succeeded very well? I will not advert to the imperfect success of No. 11, which, according to Liebig's theory, ought to have succeeded best; but, confining ourselves to Nos. 4, 5, and 10, I would ask if a rule inadequate to explain every case ought to be considered as certain, or rather if a theory which explains certain results, but leaves other results, obtained under analogous circumstances, unexplained, is deserving of the support of the unprejudiced? It may perhaps be said that the apocrenic acid and the humic acid from mould differed so much from ulmic acid obtained from sugar and humic acid from peat that they entirely prevented the action of the ammonia with which they were combined. But this objection possesses very little weight, and, as I know of no other which could be advanced, I shall proceed with the consideration of another and more important objection, namely, the alleged unfair condition in which plants are placed when grown in sand, ashes, and water.

As to this, I would ask—if plants require nothing but carbonic acid, water, and ammonia, (all of which they ought to have

obtained from the air,) and a few inorganic compounds, which, as is proved by the experiments of Wiegmann and Polstorff, are gradually dissolved from the sand, through the protracted action of the atmosphere, but which were in this case previously supplied by the wood-ashes—if, I say, plants require nothing else, why was the sand, &c., an unfair condition for the plants to grow in? All that the roots require—moisture, darkness, a certain degree of heat, and the access of atmospheric air—was here present, and, nevertheless, this is called an *unfair condition*. I am unwilling to call this assertion a pretext for avoiding explanation or discussion on account of a conviction of the weakness of the principles advocated.

It is easy enough to maintain a theory, if we are allowed to bring it into operation in the manner most suitable to the theory itself, but both impartiality and respect for the opposite theory induced Mulder, to prevent, as much as possible, the plants from obtaining their organic food from any other source than the atmosphere; hence, if this experiment had succeeded it would have been a most brilliant proof of the truth of Liebig's theory; but, had the plants been placed in a so-called fair condition, by which, I presume, is meant certain admixtures of organic matter, the experiment, however successful, could not have been considered by an impartial judge as any proof whatever of the correctness of his principles.

I shall for a moment advert to what Liebig calls absurd—the formation by a diseased plant of a substance to which its health and vigour are to be ascribed. I would beg to place the question in a somewhat different light. Is it not very natural and obvious that a product of a plant, when no longer under the influence of vital action, and hence in a state of putrefaction, should first be converted into those substances which, in the growth of plants, constitute the transition to a perfect organization? If the question regarded some special substance, gum or resin for instance, excreted in consequence of a peculiar direction of vital action in healthy plants, it would be absurd to assume that these excretions, *as such*, were proper food for the plant; but humus is a *general* product into which all putrefying organic bodies are convertéd, and can, therefore, by no means be termed an *excretion*. The product of the diseased elm in question was evidently no longer under any influence of the vital action when it was converted into humus, and hence a difference should be made between the immediate and peculiar product of a certain disease and the secondary state of humus into which this product is subsequently changed.

The well-known fertilizing action of charcoal requires, indeed, no other explanation than its characteristic property of con-

densing gases, through which, a large quantity of atmospheric air being condensed within a small space, and in a condition as yet unknown, a far larger proportion of oxygen and nitrogen is afforded to the putrefying matter, as I shall afterwards have an opportunity of explaining: hence, therefore, it has no direct relation to the production of carbon in plants.

I think it proper to advert here to some opinions of Professor Johnston upon this point,* which tend to shew that this distinguished writer agrees completely with Mulder's views. He says that experiments have proved that the bulk of oxygen exhaled by the leaves is generally smaller than that of the carbonic acid absorbed by them—a fact which has induced Berzelius and Persoz to assume that, not the carbon of this carbonic acid, but carbon in some lower state of oxidation (according to Persoz, carbonic oxide) is retained by the plant. Further, that, as far as is yet known, neither the stem nor the roots have the power of decomposing carbonic acid or secreting oxygen. If, therefore, plants take up carbonic acid from the soil, it must either be in small quantity, or the bulk of oxygen separated by the leaves during the day must be considerably greater than that of the carbonic acid taken up by them, or else the stem and the roots must have the power of secreting oxygen also. The two latter circumstances appear to be in opposition to experience, and hence the former is also untenable.

The same writer further remarks, that as the colouring matter of *Phytolaca decandra* and of *Rubia tinctorum* are absorbed by plants—that of the former penetrating, as shewn by Biot, in the case of a white hyacinth, as far as the flower—this proves the *possibility* of organic substances entering through the roots into the circulation of the plant. Davy has also shewn that plants of mint grow vigorously in solutions of sugar, gum, jelly, &c., even when the soil in which grass grew was watered with those solutions, the plants throve better than when common water was applied.

Though I admit, therefore, that the quantity of carbon which the plant derives from the assimilation of soluble organic substances in the soil *varies* with circumstances, I consider it most absurd to suppose that, when the water in the soil is impregnated both with soluble organic and inorganic substances, the roots should have the power to *select* the latter and to *refuse* the former.

II. Now, proceeding to the very interesting experiments on ammonia, I shall again commence by giving a simple account of the experiments themselves, and then go on to weigh the importance of the objections which have been adduced.

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* "Lectures on the application of Chemistry and Geology to Agriculture," p. 88-203.

Before commencing this, however, I must first prove the *possibility* of the nitrogen of the air being converted into ammonia, as well as into nitric acid. I am well aware that the inactivity or indifference of nitrogen has been advanced as a proof to the contrary; but, in reply to this, I would ask whence has ammonia been derived originally? Was ammonia present, ready formed, from the creation of the world, and is the quantity in the world and its atmosphere exactly as great now as it was then? If the absurdity of this be admitted, why may not the same causes, by which ammonia was first formed from nitrogen and hydrogen, still produce the same effect? It is indeed such a theory as ascribes the origin of ammonia in the soil to nothing else than to the ammonia washed down from the air by the rains, that is obliged to assume an atmosphere, filled with little germs invisible to every one but to the supporters of the theory themselves, and to consider *peculiar* germs indispensable for the production of mould plants.

But I must not anticipate. I shall first prove the *possibility* stated above, and the *non-indifference* of nitrogen, by the following facts:—

1°. Cavendish obtained nitric acid by passing electric sparks through moist atmospheric air.

2°. The same acid is produced when a mixture of nitrogen and hydrogen is burned in the air.

3°. Coke, when heated to redness with potash, in a current of air, produces cyanuret of potassium.

4°. When reddened litmus paper is hung up in a bottle filled with pure atmospheric air, having pure iron filings moistened with pure water laid at the bottom, the red litmus is turned blue by the action of ammonia formed from the nitrogen in the air and the hydrogen of the decomposed water, the oxygen of which has combined with the iron. When either the iron filings or the water is absent, no change of colour is produced.

To this last fact it is objected that the blue colour may be caused by de-oxidation of the red. But what can be objected to the following considerations?

It is not proved that the blue colouring matter of litmus contains less oxygen than the red. Therefore there is no reason why by this action the blue colour should be produced in preference; but, even granting that de-oxidation is the cause of this change of colour, then the same explanation may be applicable to the action of alkalis. If this is true, the action of alkalis and that in the above experiment coincide, and we are not a step farther forward by assuming the foregoing explanation.

To these facts I may add a few more, as recorded by Professor Johnston in his "Lectures."

In some volcanic districts, more especially in Italy and Sicily, ammonia is given off in combination generally with some acid; most frequently in the form of sal-ammoniac.

According to Berzelius, when organic substances which contain no nitrogen are oxidized in the air, ammonia is not unfrequently formed.

According to Faraday, when certain oxidized substances are decomposed in the air by means of potassium, or when metals are rapidly oxidized by means of nitric acid, a variable quantity of ammonia is produced.

When a current of moist air is made to pass over red hot charcoal, carbonic acid and ammonia are simultaneously produced.

Ammonia has been detected by Berzelius in the compact iron-ore of Dannemora, probably in consequence of the gradual trans ition of part of the protoxide into deutoxide, by decomposition of the water, the hydrogen of which combines with the nitrogen of the air.

The latter facts may serve to explain the former in a satisfactory manner. For at great depths beneath the surface of volcanic regions, combustible, or at least oxidizable, matter almost necessarily exists; and, as the presence of steam, mixed with a limited quantity of air, is equally probable, these conditions are sufficient to account for the production of a certain quantity of ammonia.

The *possibility* of the nitrogen of the air combining with hydrogen to form ammonia being thus proved, I shall proceed to the account of Mulder's experiments, in order to arrive at something more definite than mere possibility, and even than probability.

1°. Powdered charcoal, recently heated to redness and carefully allowed to cool, was mixed with pure warm water in a bottle, one-eighth part only of the bottle being filled with the mixture. After about three months, the charcoal, mixed with caustic potash, gave distinct indications of ammonia.* When the charcoal was treated with water, this remained entirely colourless, a proof that no apocrenate of ammonia was formed. This is of importance, because it results from the experiments mentioned above that apocrenate of ammonia does not favour vegetation, which might be considered as the cause why plants refused to grow well in a mixture of charcoal and ashes as stated above.

The presence, however, of an organic substance seems to be almost a requisite to the commencement of the formation of ammonia.

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* It was previously ascertained that the charcoal itself produced no ammonia whatever when treated with caustic potash.

2°. Ammonia was also found to be abundantly produced when humic acid and water, both free from ammonia, were kept in a bottle, partially filled, and closed with a glass stopper for six months.

It may be as well here to mark that I saw in Professor Johnston's laboratory a bottle containing dry humic acid which had been closed for a long time. On examination for a certain purpose, I found that a portion of a soluble coloured salt of ammonia had been formed.

3°. When pure potato starch was substituted for humic acid, the action in the bottle became so vehement, that by merely touching the stopper, it was with violence thrown out of the neck. The mixture had a strong smell of cheese, and gave most abundant proof of the presence of ammonia.

Gum Arabic, cane sugar, milk sugar, all gave the same results.

Mulder farther found that, when pure milk sugar or cane sugar, repeatedly re-crystallized, was dissolved in pure water, in a glass-stoppered bottle, about one-eighth of the bottle being filled with the mixture, after a few days mould appeared, which, by dry distillation, yielded ammonia abundantly.

Upon the foundation of these *fair* experiments, Professor Mulder proceeds to state that the arable soil is precisely in the same condition as the charcoal, the humic acid, &c. were in his experiments, and that really a continual formation of ammonia from the nitrogen of the air is going on in the soil, whence is explained the quantity of nitrogen in arable land, even where no ammonia is added extraneously, and the presence of nitrogen in plants grown in un-manured soils.

Mulder also found that a number of little plants were produced in solutions of potato starch, acetate of potash, nitrate of potash, binoxalate of potash, &c., even in chloride of calcium, sulphate of soda, and common alum. I have myself seen them in solutions of neutral tartrate of potash and of sulphate of alumina.

These plants were submitted by Mulder to the skilful botanist, Dr Miquel of Rotterdam, for examination, who was able to recognise them as belonging to the genera *Cryptococcus*, *Ulvina*, *Hygrocrocis*, *Sirocrocis*, and *Leptomitus*.

It has been objected to these results, that only such a solution of tartaric acid as contains decaying organic matter will produce mould plants, of which the *supposed* germs would thus find their proper food, and that the plants produced in Mulder's experiments owed their origin to a similar source. This objection hardly requires any serious consideration. Certainly no chemist, and Mulder least of all, would allow such a source of error to exist. I am not only convinced that no body who understands the

importance of the subject will consider such a mistake possible, but I am even inclined to think that the party by whom this objection has been advanced has not done so seriously.

But, moreover, whence, I would ask, could the decaying organic matter come in a solution of chloride of calcium, alum, or sulphate of soda in pure distilled water?

I think it almost certain that any solution of an organic acid or salt, in a partially filled bottle, however well protected from the surrounding air, will produce mould plants; but I take the liberty of entirely rejecting the obsolete idea of a vital force *as a concrete*, to ascribe this phenomenon to the meeting of the four organic elements in the nascent state, possessing their original, unweakened, molecular forces. This however would lead me too far; and I am satisfied to have shewn the weakness of the above-named grounds, upon which it is assumed that Professor Mulder has possibly been deceived by his own careful experiments.

I shall add one or two more conclusive experiments made by Mulder upon this subject.

Powdered charcoal, mixed with one per cent. of wood ashes, was placed in two glass vessels. To one ulmic acid from sugar was added, and both vessels were placed in an atmosphere free from ammonia. Three brown beans were sown in the former (charcoal and ashes) and three white beans in the latter. The first grew very poorly, the second very luxuriantly. After twenty-four days the plants were taken out, the roots completely and cautiously washed, the whole dried and weighed. Both the remaining charcoal and the mixture of ulmic acid and charcoal gave off ammonia abundantly when distilled with caustic potash.

The three brown beans,	dried at 212°	weighed	1.277 grammes.
The three plants produced,	„ 212°	„	1.772 „
The three white beans		„	1.465 „
The three plants produced		„	4.167 „

The ratio of increase in weight was therefore—

Brown beans,	1—1.39
White beans,	1—2.84

The proportion of ash left by

The brown beans was	3.7 per cent.,	their plants	9 per cent.
The white beans was	4.7 „	„	8.4 „

The proportion of nitrogen contained in

The brown beans was	27 cub. cent.,	their plants 54 cub. cent.,	ratio 1 to 2
The white beans was	50 „	„ 169 „	1 to 3

The increase of nitrogen in the beans grown in charcoal and ashes, therefore, was 100 per cent., that in the beans grown in the mixture with ulmic acid, 200 per cent.

Whence plants derive their nitrogen is, according to Liebig,

very clear—it is the ammonia in the air, washed down by the rain-water. But Professor Liebig himself says that *traces* of ammonia can be scarcely detected in large quantities of rain-water; and, though assuming—on what grounds is not mentioned—that a pound of rain-water contains one-fourth of a grain of ammonia, it is obvious that, by a continuous rain, only the part that *falls first* would contain this quantity, and what falls subsequently would soon be without any ammonia at all. The minute quantity of ammonia contained in the air above a field, is certainly far from being a sufficient source for all the nitrogen contained in the plants growing upon it.

But the following demonstration will shew how much more probable and natural is the explanation given by Mulder, which makes it quite unnecessary to assume, as has lately been done, humorously I suppose, *that hot solutions* of alkalis ought to be showered down to make the humic acid soluble.

All the decaying organic substances present in the soil are principally derived from the two chief constituents of organized beings—woody fibre (including starch, gum, sugar) and protein compounds. The composition of the former is either—

$$C^{24}\ H^{21}\ O^{21}$$

Or, $$C^{12}\ H^{10}\ O^{10}$$

Of the latter, $$C^{40}\ H^{31}\ N^{5}\ O^{12}$$

Now, in whatever way the decay of these substances in the soil be conceived—the main products being humic, ulmic, and crenic acids—there will always be a large excess of hydrogen,* which, being in the nascent state, has all its properties unweakened. It is, moreover, set free amidst a decaying and porous organic substance, with a limited access of air and at a low temperature—conditions essential to effect the production of ammonia, and to prevent that of nitric acid; and is, therefore, in the same circumstances as it was in Mulder's experiments mentioned above. Hence it will most likely give rise to the same product, *i.e.* ammonia. The decaying organic matter sets free, carbon, hydrogen, oxygen, and a little nitrogen. The carbon, obeying its strongest tendency in this condition, forms carbonic acid in so far as it can find oxygen enough present in the air, which is continually circulating through the porous soil. The small remainder of carbon, if a sufficiency of oxygen cannot be procured, will combine with part of the hydrogen, and hence the quantity of carburetted hydrogen in marshy places and stagnant waters. The remainder of the hydrogen takes the nitrogen, simultaneously liberated from the

* It would take too much space to give diagrams here with the view of representing this, but it will be found amply explained in Mulder's work, "The Chemistry of Animal and Vegetable Physiology," part, I., pp. 171-2.

plant, and also from its intimate mixture with the oxygen in the atmospheric air, and thus ammonia is formed. This ammonia, the extraordinary affinity of which for humic, ulmic, and crenic acids is very well known, combines immediately with part of the decaying substances, when still in the state of humus, either extracting or producing humic and ulmic acids, with which it forms humate and ulmate of ammonia, so extremely soluble in water, and fit for progressive decomposition within the cellular tissue of the plants. Now, it is evident from this, that, as the said production of humic acid and ammonia is going on gradually, there are only small quantities present at the same time in the soil, that which is formed being instantly taken up by the roots. There is a continual formation and absorption of them, and thus, though no hot alkaline solutions shower down upon the soil,* though the liquid is always cold and weak, and so adapted to the tender extremities of the roots, it is *constantly* present, and so a sufficient and nourishing supply is present wherever required.

The beautiful connexion which this theory constitutes between the production and use of ammonia and the humic acids in the soil is evident, and certainly not the least of the advantages of the theory itself. It agrees remarkably well with the great rule in nature, that there is a close relation of causation between every two products whose presence is necessary to each other. The last-mentioned experiment of Mulder, shewing the luxuriance of plants grown in a mixture of charcoal, ashes, and ulmic acid, superior to those grown in mere charcoal and ashes, and, at the same time, the larger quantity of ammonia *produced* and assimilated by the former, apparently tends to solve two problems at once.

A few remarks advanced by Professor Johnston may serve here as a further support of the above-named conclusions.

The ammonia produced in the air from decomposed vegetable and animal matters can but very imperfectly be restored again and rendered available for vegetation. The greater part is washed down by the rains into the sea, and of that which is carried down by the rain into the soil, another part is further washed out and carried to the sea, and may be considered as directly lost to the soil.

What now remains in the air will undergo continual decom-

* I should not have thought it necessary to remind a chemist that humic acid is *not dissolved in water* containing a *little* ammonia; but that every atom of ammonia produced combines with an equivalent of one of the organic acids present in the soil, and that this *organic compound* is dissolved in water. It is clear that, even though the quantities of ammonia were very minute—like the traces contained in rain-water—this can have no influence upon the *solubility* of humic acid, but only *upon the quantity of humate of ammonia produced in a given time.*

position by the constant action of electricity, and much more by that of thunder storms. Could the small part which is finally left in the atmosphere and brought down to the soil account for the whole quantity of nitrogen that is found in the plants produced? Besides, part of the small quantity of ammonia thus returned to the soil and taken up by the plants is again decomposed in their interior, and the nitrogen given off, as is *proved* to be done by the leaves of some and the flowers of other plants—a fact most strangely explained by Liebig as affording a proof *that plants get more ammonia from the air than they require for the formation of their nitrogenous constituents.*

This leads Professor Johnston to the very plausible conclusion that nitric acid is produced also in considerable quantities in the air and the soil, and that by this means, *in some degree*, is made up the deficiency of nitrogen arising from the several losses of the existing ammonia sustained in a way which prevents its being all replaced by a reproduction of ammonia. The existence of nitric acid in the soil, especially of the hotter regions, where nitrates accumulate to a great amount, is a known fact; and, though partly the same causes contribute to the diminution of this acid as are at work with respect to the ammonia in nature—viz. the washing away by the rains—yet there are so many causes of reproduction—viz. thunder-storms, putrefaction in the open air, and at higher temperatures, &c.—that, in this way, there is a much fuller compensation for the quantity which is lost.

The same writer farther states that the putrefaction of organic substances is, in temperate regions, necessary to cause the formation of nitric acid *to commence*, but will proceed after that for any indefinite period, at the expense, apparently, *of the nitrogen of the air only*, and that the comparatively large quantities of nitric acid in the soil of hot regions is attributable to the far more rapid decay of organic matter in those climates attracting a far greater quantity of oxygen, by which that of ammonia must become proportionately less.

This action of decaying organic matter is explained by the well-known principle in chemistry, that bodies, when in a state of oxidation, excite a disposition to the same change in substances with which they are in contact, especially so if other substances are present ready to combine with the bodies newly produced; the potash, lime, and magnesia in the soil, are very apt to form a combination with nitric acid.

From the above statements, it is highly probable that nitric acid contributes, as well as ammonia, to the production of nitrogen in plants; and in tropical regions there is reason to believe that a great part of the nitrogen is thus afforded, and even that nitric acid penetrates, either as such or in the state of a nitrate,

into the plants. The ammonia being far more easily decomposable than nitric acid, the latter requiring a comparatively high temperature and light to yield nitrogen to plants, it appears to be in beautiful harmony with the economy of nature to change the nitrogen of putrefying substances into nitric acid, in those regions only where plants are under the condition of decomposing it again—their growth being most vigorous and rapid—their vital action intense. In the soil of temperate regions, for the same reasons, the nitrogen is, no doubt, almost all in the state of ammonia; but, from what has been said of the action of decaying substances in general, it is probable that nitrates are found in *every* cultivated soil.

The final conclusion to which we are led by this, especially from what we know to be the case in tropical vegetation, is again much in favour of Mulder's theory, that the ammonia in the soil serves as a medium or vehicle to transfer the oxygen of the air to the putrefying substances; for it renders unnecessary the assumption, that the nitric acid produced ought to be *all* reduced to ammonia again to yield nitrogen to the plants.

There are, however, many who think that we may fairly claim the preference for those theories which support aerial nutrition—that they exhibit a degree of simplicity and beauty consonant with the other works of nature.

Simple and beautiful indeed are all the works of nature in the highest degree. This we are entitled and obliged to assume for *all* of them from the parts now known to us. I do not deny, also, that a theory, in accordance with this simplicity and beauty, deserves the preference above all others, but such a theory ought to possess the advantages of being *true*, or at least *probable*, and of explaining the *whole process in all its gradations*. I am well aware that all the carbon in plants must have been originally derived from the atmosphere, and that the final results of the decomposition of organic bodies are carbonic acid, water, and ammonia. But the science of nature has another task to perform than merely to point out *final* results. If this were its only object, we could now say that we know all that is to be known.

The simplicity and beauty, therefore, of the said theory, are only *real* if the theory gives an easy and clear explanation possessing the character of truth. This leads me to a last ground of refutation. To whom does it appear easier to conceive the decomposition of carbonic acid—whose elements are united by an affinity the strongest possible at ordinary temperatures—in plants, than that of the easily decomposable humates and ulmates of ammonia? Then experience is in full accordance with theory; for every natural philosopher must know that a molecule, whose axis is attracted in one direction only—as is the case in carbonic acid—is under the dominion of a far more intense action than if

acted upon in two or even three directions, as is the case in humate of ammonia. For, considering an atom to be endowed throughout with a fixed quantity of attractive power, which is brought into action upon meeting other atoms, the part of that power used to attract in one direction must be substracted from that used in another direction, and so lead to weaken it, and to modify the coherence of the whole compound.

Now, if the complex organic product, humus, has first to pass into the state of carbonic acid before entering into the cellular tissue of the roots, would it not appear as if it were the object of nature to *increase* the labour of the cells without any apparent purpose? The leaves cannot obtain their carbon *directly* in any other form than in that of carbonic acid; and, even here, the decomposition of this compound can only take place under the influence of the sunshine. But the roots have not this powerful assistance, and at the same time they are placed in immediate contact with a substance far more easily decomposable than carbonic acid, and, supplying the four organic elements all in their nascent state, that is, possessed of all their unweakened properties. Since we know, moreover, that for the continual growth of a plant it is necessary that, along with the other elements, carbon should be continually fixed and worked up within the plant, the theory advocated by Liebig and his followers leaves us nothing but the alternative either to assume that plants *do not grow at all* in the dark, or that the extremities and cellular tissue of the roots can do more than the leaves—can decompose carbonic acid without the assistance of the sunshine.

The former is not the case, for plants do grow in the dark, though but imperfectly, and some even become green, as some species of *Poa*, *Plantago*, and *Cheiranthus* in mines, (Humboldt.) The latter is directly opposed to the rash supposition advanced by the same parties, that the cellular tissue of the roots should act as mere mechanical tubes, through which the carbonic acid, water, and ammonia, are merely passing, to be decomposed on their arrival in the leaves. In this manner the cellular tissue of the roots, an organic body, would represent itself almost as a dead body without any active property;—the cellular tissue, in which the highest functions of life reside.

But, if the cellular tissue of the roots acts, and acts differently from that of the leaves, as it no doubt does,* considering the different circumstances under which the roots are placed, then

* Liebig's theory renders it necessary that the cells of the roots should act either with *less* or with *more* energy than those of the leaves. That it is *less*, and, therefore, allows the fluids to pass unchanged to the leaves, is contrary to the fact that the oxygen given off by the leaves is always less in bulk than the oxygen taken up by them; that it is *more*, is an arbitrary assumption, and is also in opposition with the fact, a negative one I confess, that, hitherto, oxygen has not been found to be given off by the roots.

nothing entitles us to assume that its actions are more intense than those of the leaves; and, much rather than suppose that they are, because they cannot be assisted by the influence of the sunlight, I would incline to think that, because of the want of that influence, and not unnecessarily to increase the labour of the cells in the roots, they are placed in immediate contact with a substance fit for easier decomposition than carbonic acid, and supplying all the necessary organic elements in the nascent state.

This view I venture to call comprehensible, and, as to its simplicity, let us imagine the humate of ammonia—of which the constituents have their forces in a dormant state in consequence of their combination—to be decomposed. Then the four elements of which the organic part of all organs is understood to be built up are at once set free, and, being in their nascent state, endowed with all their original unweakened forces, find themselves in a condition to form such new combinations as are necessarily provoked by the conditions in which they are placed at the moment of their liberation. From all that we yet know of the works of nature, we see that wherever *one* substance, from *one* source, can with *equal* facility serve her aims, she, with wise economy, never employs *two* from *two* sources. Here the facility with which that aim can be attained through *one* substance is apparently still *greater* than that which would attend the use of two substances obtained from two sources; and as, besides, both induction and actual experiments quoted before go to prove that the organic substances in the soil are, *as such*, taken up by the roots, I think myself compelled to call this theory, really consistent with the simplicity of the actions of nature, comprehensible, and preferable to the opposite one, resting chiefly on uncertain calculations of probabilities, and confessions of individual impotence to give an explanation to certain phenomena which is different from the cherished assumption, without even any serious attempt to confirm that explanation by direct experiments.

The fear of taking up too much of the valuable space of this Journal alone makes me stop here, without further advancing my independent opinions; and it is my sincere hope that chemists and physiologists will, more and more, follow the example of such as sincerely attempt to walk on a *firm* ground, as it is only in this way that we can hope to prosecute, successfully, the study of these most interesting sciences.

NOTICE OF SOME AGRICULTURAL ANALYSES MADE BY STUDENTS IN THE GLASGOW UNIVERSITY LABORATORY.*

By Robert D. Thomson, M.D., Lecturer on Practical Chemistry in the University of Glasgow.

In directing attention to the proper mode of studying agriculture, it is scarcely necessary to urge the importance of chemistry in enabling the farmer to understand the relation subsisting between his soil and his crops. The only question for consideration is in réference to the mode in which he is to acquire the requisite knowledge of this science, in order that he may render it practically beneficial in the management of his farm. The perusal of chemical works is, no doubt, important; but, without seeing and handling the substances described in these treatises it is impossible to form any adequate notion of their nature; even attendance on lectures is not alone sufficient, since the student in that case does not personally scrutinize the operations exhibited by the lecturer, and has no time allowed him to examine with care the reactions produced. Some considerable experience in the chemical education of farmers, as well as of students intended for other professions, has led to the conclusion that the only possible way in which a farmer can acquire a proper knowledge of chemistry, suited for the purposes to which he wishes to apply it, is by *working* in the laboratory, as well as by attendance on lectures. The farmer is frequently cautioned against the idea of devoting himself with energy to the study of chemistry, with what prudence it is perhaps difficult to discover. He may justly consider himself as a chemical manufacturer; but under circumstances requiring greater foresight than the latter. The chemical manufacturer is capable of exercising, in general, a complete control over his processes, unaffected by mysterious influences; while the farmer requires to study meteorological phenomena, so as to provide against the worst effects of causes over which he has comparatively insignificant power, and is, therefore, in need of every auxiliary which shall enable him to contend with such an unfavourable position. Hence the farmer in reality requires a more extensive scientific knowledge than any manufacturer of one commodity. To accustom agricultural pupils to distinguish the substances which they are likely to meet with in their experiments, it is necessary that they should have a general knowledge of the characters of the simple bodies in chemistry, including their oxides and sulphurets. This is effected in the

* Forming part of the concluding Lecture of Session 1844–45.

Glasgow laboratory by a system of testing, by means of a small manuscript work which I have drawn up for the use of the pupils; and, in consequence of the restriction of the means of discrimination to a few characters, I find that greater precision is attained than by more elaborate systems, and that time, which constitutes a great portion of the industrial capital in this country, is materially economized. During the period that the testing processes are proceeding, the student attends the practical demonstrations, where he assists in performing the experiments; and he thus rapidly is enabled to understand the nature of an analysis, not by mere description, but by actual practice. As soon as he has tested a substance, that is, has ascertained the nature of the ingredients of which it is composed, he is capable of understanding the methods by which these materials can be separated and their weight estimated. He begins with some simple salt, and then proceeds to more complicated bodies, and is, at last, gradually enabled to trace the connexions between soils and rocks, by such sure inductive processes. The complete analysis of a soil is one of the most tedious and complicated in which a chemist can engage. The student cannot, therefore, be expected to comprehend it without considerable preparation.

Greywacke Soil.—But by explaining geologically the dependance of the soil upon rocks, and tracing the production of various soils from their respective rocks, not only may much interest, but much instruction, be derived in the chemical studies of the agriculturist. During the last winter, many careful analyses of rocks have been made. These I do not intend to describe at present; but, as an example of the importance of such analyses, I may notice those of the greywacke and the superimposed soil at Balkerr in Wigtonshire. The experiments were conducted by my pupil, Mr James M'Bryde, under my immediate direction. The analyses of the rock and soil are placed in parallel columns for the sake of comparison.

Specific Gravity of the Rock, ... 2.76

Decomposed Soil.	Soil.	Greywacke.	Partially Undecomposed Soil.	Soil.	Greywacke.
Fibre, ...	1.01		Gravel, ...	6.39	
			Stones, ...	19.16	
Organic Matter and some Water of Undecomposed Soil,	12.51		Silica, ...	38.79	72.18
			Alumina, . . .	8.30	11.68
Phosphate of Iron, .	2.49	0.94	Magnesia, . . .	0.69	2.30
Peroxide of Iron, .	7.60	9.94	Lime, ...	0.55	0.96
Carbonate of Lime, .	.74		Potash and Soda,		0.95
Magnesia, ...	1.72		Water, ...		2.40
Chloride of Sodium, Sulphate of Lime,	0.05	trace.			

The important fact that phosphoric acid is contained in greywacke is demonstrated by this analysis. In another examination we found a somewhat larger amount, and the variation may be considerable in different localities. A comparison of the preceding columns enables us to deduce the effects of cultivation. It is obvious that phosphoric acid and carbonate of lime have been added artificially. Phosphoric acid has been long known to exist in volcanic rocks, (Boussingault's *Economie Rurale*, i., 561,) but I am not aware that its occurrence in primary rocks was pointed out until the experiments made here in 1843, upon lichens, demonstrated the fact.* I have since analyzed all the primary rocks, and have never found it absent. Indeed the former experiments have demonstrated that on such rocks as we find lichens growing there we may infer the presence of phosphoric acid, and of various salts.

Greenstone Soil.—The following analyses were made by Mr James Paterson, Barnego, near Denny. The greenstone upon which the soil is superincumbent consists of hornblende in small crystals, with portions of quartz and some particles of calcareous spar. There is probably also felspar, but, owing to the minute nature of the ingredients of which the rock consists, it is difficult to discriminate the substances with the eye. The analysis of the rock and soil has been repeated each twice :—

	SOIL.		GREENSTONE. Spec. Gravity, 2.91	
	I.	II.	I.	II.
Silica,	50.00	49.70	50.20	51.20
Phosphate of Iron,	6.10	6.66	2.00	2.04
Peroxide of Iron,	14.04	14.16	26.40	20.66
Alumina,	5.60	5.83		6.30
Lime,	2.64	3.50	9.12	8.76
Magnesia and some Potash,	4.20	4.31	10.40	9.66
Soluble Salts,	1.63	-	-	-
Organic Matter,	10.69	-	-	-
Water,	5.00	-	2.00	1.50
	100.00		100.12	100.12

The large amount of magnesia in the rock obviously belongs to the hornblende, the predominating constituent of the rock.

* See the Journal of Agriculture for January 1845, No. VIII.

Greenstone, Carse, and Moor Soils from the neighbourhood of Stirling.

	King's Park, Stirling.						Stewart-hall Carse,		Polmaise.	
	Dryfield.		Do. Subsoil.		Do. Carse.					
	I.	II.	I.	II.	I.	II.	I.	II.	I.	II.
Organic Matter, with some Water,*	11.53 to 15.75	–	9.36	–	7.55	–	5.00	–	9.25	8.20
Phosphate of Iron,	9.52	6.10	7.40	6.58	1.98	1.61	1.75	2.10	0.66	0.81
Peroxide of Iron,	14.67	–	15.58	12.12	10.22	–	2.06	5.05	3.60	
Carbonate of Lime,	0.75	–	1.17	–	0.77	–	6.40	4.82	0.12	
Lime, ...	0.87	2.50	1.60	–	–	1.30	–	–	–	0.69
Magnesia, . . .	–	–	2.00	–	1.89	1.45	3.26	1.40	0.57	0.56
Soluble Salt, consisting of Chlors and Sulphates,	0.06	–	0.20	–	0.39	–	0.40	0.25	–	
Clay and Sand, .	–	–	–	–	68.43	–	73.57	–	67.76	
Gravel, . . .	25.07	–	19.98	–	8.54	–	0.50	–	16.37	
Silica, ...	29.36	50.00	37.70	–	–	61.05	–	67.70	–	72.95
Alumina, . . .	2.60	–	4.83	–	–	14.35	–	13.23	–	15.31 & Iron
Fibre, . . .	–	–	–	–	–	–	–	–	1.75	

* Coaly matter.

The first of each series was analyzed by myself and assistants, and affords a view of those substances which are more particularly important to the farmer to know. The second analysis of each series was made respectively by the following gentlemen, Mr George Alexander, Mr Macmoneagle, Dr Lewis, R.N., Mr James Paterson, and Dr Lewis. The amount of phosphoric acid in the phosphate of iron is considered by Boussingault to be obtained by dividing by two.

British Guano.—The importance of phosphoric acid in the formation of the nutritious portion of grain renders the detection of its occurrence in any new locality a matter of some consequence. The following analyses of guano from Ailsa Craig, for a specimen of which I am indebted to Dr Balfour, gathered by him during a botanical excursion to that island during last autumn, is, therefore interesting. The analysis was conducted by my pupil, Mr M'Latchie.

	1.	2.
Water, ...	50.30	64.04
Organic Matter and Ammoniacal Salts containing 3.47 per cent. of Ammonia,	12.50	
Phosphate of Lime, ...	12.10	16.25
Phosphate of Magnesia, ...		
Oxalate of Lime, ...	1.50	1.00
Sulphate of Potash, ...	1.00	1.20
Phosphate of Potash, ...		
Chloride of Potassium, ...		
Earthy Matter and Sand, ...	15.00	15.00

I have also had an opportunity of analysing a specimen of guano, brought, I believe, from the coast of Ireland. It contained—

Water, ... Vegetable Matter and Animal Matter containing 2.28 per cent. of Ammonia, . .	50.20
Earthy Matter and Sand, ...	23.85
Phosphate of Lime, ... Phosphate of Magnesia, ...	21.15
Oxalate of Lime, ...	3.80
Sulphate of Potash, ... Phosphate of Potash, ... Chloride of Potassium, ...	1.00

The amount of soluble salts was so small, having been washed out by meteorological causes, that it was unnecessary to determine the quantities of sulphuric acid and phosphoric acid present —a precaution which is essential in the analysis of guano, since all specimens contain nearly the same amount of phosphate of lime, when the guano has been imported from the same locality—but the ammonia, sulphuric and phosphoric acids of the soluble salts, vary considerably. These, too, it should be borne in mind, constitute essential characters of a manure, since without their presence no grain capable of serving as nourishment to animals can be produced.

Limestones.—The experiments made in the Glasgow laboratory have proved the existence of phosphoric acid in the Irish limestone in minute quantity, but in a somewhat greater amount than in the English chalk—thus establishing chemically the parallelism of these two rocks in a geological point of view. The determination of this fact was conducted by Mr John Thomson, A.M., in a most satisfactory manner. Limestone from Lorne, which is employed abundantly at Glasgow and on the Ayrshire and Wigtonshire coasts, was examined and compared with chalk from Cromer on the coast of Norfolk. The results were as follows :—

Phosphoric Acid in Cromer Chalk, ...	0.77	per 1000 grains.
... Irish Limestone, ...	0.905	...

Scottish Magnesian Limestone.—I requested Mr James C. Stevenson to examine the magnesian limestone of Sutherland for phosphoric acid, but we could not detect a trace of it in 1500 grains. We then turned our attention to the magnesian limestone of Berwickshire, as found on the Tweed between Kelso and Coldstream, and formerly burned at Hadden, and which I had found some years ago to possess the following composition :—

	1.	2.	3.
Specific Gravity,	2.723		
Carbonate of Lime,	49.600		
Carbonate of Magnesia,	44.000		
Silica,	4.000		
Phosphate of Iron,		0.74	0.727
Peroxide of Iron,	1.200		
Alumina,	1.000		

We found it to contain a decided amount of phosphoric acid, as exhibited in two trials made by Mr J. C. Stevenson.

A similar limestone exists in Stirlingshire, at Boquhan, and is believed to extend to the south-west, although I have not had an opportunity of tracing it. For the opportunity of examining this limestone I am indebted to the attention of William Murray, Esq. of Polmaise. The specific gravity of this limestone varied from 2.753 to 2.830 and 2.833.

The following are analyses of four different specimens:—

	1.	2.	3.	4.
Carbonate of Lime,	53.09	56.07	53.06	54.00
Carbonate of Magnesia,	43.49	39.34	43.11	—
Phosphate and Peroxide of Iron,	0.96	0.74	2.34	—
Silica and Alumina,	2.46	3.85	1.49	—

The first analysis was made by myself; No. 2, by Mr Archibald Sinclair, Hillhead, Stirling; No. 3, by Mr John Thomson, jun.; and No. 4 by one of my assistants.

By three analyses, the composition of this limestone was ascertained to be, stating it in another form—

	1.	2.	3.
Lime,	29.73	27.886	
Magnesia,	22.50		20.465
Phosphate of Iron,	0.96	0.431	0.279
Silica and Alumina,	2.46	0.862	2.958
Carbonic Acid and Water,	44.35	47.721	46.500

Common Limestones.—It becomes interesting to compare these analyses with common limestones from the same neighbourhood. The two following analyses exhibit the composition of specimens of limestone from different parts of the strata at Murrays-hall, as made by Mr Archibald Sinclair under my direction:—

	1.	2.
Carbonate of Lime,	93.32	97.80
Peroxide of Iron,	2.79	0.63
Coaly Matter,	0.28	0.64
Silica and Alumina,	1.36	1.92

I am not aware that magnesian limestone has previously been noticed by geologists as occurring in the interior of Scotland. The circumstance of its containing phosphoric acid is sufficient to distinguish it from the magnesian limestone of England, and

should render it a subject of interest to agriculturists. It is from the magnesian limestone that the magnesian salts are produced with the greatest facility, and these are of great value to the farmer. By treating the Boquhan and Tweed limestones with sulphuric acid diluted with water, a solution of Epsom salt is obtained, and gypsum or sulphate of lime is produced, both valuable as manures. The same observations apply to the magnesian limestone of Berwick and Roxburghshires.

Time will not permit me to detail many other analyses which have been conducted by agricultural pupils and others. Those which have been enumerated are sufficient to shew that, even at an early age, by careful repetition of an experiment, benefit to the cause of science may result, and important habits be acquired, which will ultimately be invaluable. Without the acquisition of such habits and such education by farmers it is in vain to look for any permanent advantage in agriculture. Without a practical knowledge of chemistry they will either be sceptical or apathetic, as the chemical language addressed to them must be unintelligible, or they must be continually liable to the deceptions of chemical empiricism.* The expense of studying practical chemistry is generally overrated—and the arrangements now adopted in the Glasgow University laboratory will bring this study within the reach of most young men who desire to improve their minds by the study of one of the most valuable and interesting sciences with which man can occupy himself. But, as a branch of general education, there is perhaps no study equally calculated to develope the mind. To make an analysis, that is, to divide a body composed of many parts united together into its ultimate constituents, a student must remember and reason if he is properly taught; and, if he enters upon a research, that is, a combination of analyses, one experiment arising out of another, until the united results enable a conclusion to be drawn, he becomes a disciple of Lord Bacon—an inductive philosopher—the safest condition for all study and for every profession. In respect, then, of the important knowledge to be acquired in the laboratory, the training which the mind undergoes is of the highest value, and I may appeal, with confidence, to all those who have passed through the studies of the laboratory, whether, whatever their future occupation in life has been, they have not had their powers of observation sharpened, and their appreciation of evidence improved by their chemical education.

* An important stimulus is likely to be given to the study of agricultural chemistry by the exertions of that excellent institution, the Edinburgh Chemical Association, in introducing it into schools.

ON INSECTS MOST INJURIOUS TO VEGETABLES AND ANIMALS, AND THE MEANS BEST CALCULATED TO COUNTERACT THEIR RAVAGES.—NO. XVI.

By the Rev. JAMES DUNCAN, M.W.S.

Lice.—Almost all our domestic animals are well known to be more or less infested with minute parasites, which have been long referred by naturalists to the genus Pediculus. The great majority of our native animals, whether wild or in a domestic state, have their peculiar kinds appropriated to them. Indeed, it was long imagined that each and every animal had its own peculiar parasite, but this is not altogether borne out by facts; for,

Although, in the majority of cases, a distinct species of insect is found upon each particular animal, *i. e.* quadruped or bird, yet there are several instances where the same kind infests three or four different species of birds, but, in such exceptions, they are almost always confined to individuals of the same genera or family, or at least to species of similar habits. This is more strictly the case with birds than quadrupeds. For instance, *Docophorus icteroides* I have found on nearly every species of duck which has come under my notice. I have received it from other birds also; but they were of aquatic habits, and belonging to the order Natatores. The *Nirmus obscurus* infests several species of sandpipers, godwits, &c.; the *Nirmus rufus* upon several of the hawks and falcons; and *Docophorus lari* upon nearly all the gulls. In the instances among quadrupeds it is rather doubtful whether the species is common to two different animals or not, or whether they may not have been merely transferred by associating or frequenting the same place of abode; as—for example, the *Trichodectes scalaris* found both upon the ox and ass—where the animals are feeding in the same stall, or sleep together, a transfer of property might easily be made. The *Hæmatopinus piliferus* infests dogs, and I have received specimens from the ferret, which last animal was said to swarm with them. Here it is rather difficult to account for the occurrence, as I am not aware that the two animals ever live on friendly terms with each other; and, moreover, the person from whom I received them informed me that he had not a dog. When we extend our observations to genera, we find they take a much wider range, and it is in only two or three cases that we could with any confidence assert that they were diagnostic of certain families of Vertebrata. It is easy to say whether they are belonging to quadruped or bird, but more difficult to pronounce the peculiar family of either, as some genera of each division appear perfect cosmopolites; as, for instance, the genus Pediculus of Linn., (since divided into Pediculus and Hæmatopinus,) besides infesting man, is also found in the orders *Quadrumana*, on monkeys; *Rodentia*, on the squirrel, hare, rabbit, water-rat; *Carnivora*, on the dog and seal; *Pachydermata*, on the swine, ass, and camel; *Ruminantia*, on the deer, ox, and buffalo. The genus Nirmus, again, is very extensively spread, infesting every order of birds but the *Gallinaceæ*. Docophorus, all but *Gallinacea* and *Columbidæ*; Lipeurus infesting the orders *Gallinacea*, *Grallæ*, *Palmipedes*, and *Accipitres*; while, on the other hand, a few, as I have stated, are nearly certain indexes to the families. Eureum only on *Chelidones*; Trinoton only on *Palmipedes*; Goniocotes and Goniodes only on *Gallinacea* and *Columbidæ*; Gyropus only on the Guinea-pig in this country. Dr Burmeister enumerates a species also from the Ai, (Bradypus tridactylus,) and, lastly, the genus Phthirius on man.*

Not only are there numerous instances of one kind of pedicular

* "Denny's Monographia Anoplurorum Britanniæ."—P. ix.

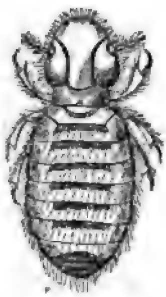
parasite being confined to one kind of animal, but in not a few cases there is a particular species assigned to different parts of the same animal, and these are seldom found to encroach on their respective provinces. This fact, in a physiological point of view, is exceedingly curious, and difficult to be accounted for. In Mr Denny's beautiful work, a quotation from which has just been given, all the species hitherto found in this country are described and figured in a style of art which has been seldom surpassed as applied to entomological subjects. He enumerates nearly 250 different species as occurring on British animals. The great majority of these are found in too small numbers to produce any injury of importance; but others, again, as is well known to every one that rears and fattens cattle, multiply excessively at times, and are productive of great uneasiness and annoyance to the animals, while they greatly impair their look by denuding the skin of the hair, and giving it a very unsightly appearance.

Naturalists differ in opinion as to whether these insects undergo a true metamorphosis, like others of their class. The truth appears to be, that the metamorphosis is very imperfect, and seems to consist in a series of consecutive changes of skin, and gradual increase in size, such as might be expected in an animal in its progress to maturity, rather than to form a metamorphosis, properly so called. In all stages they are active, and possess the power of taking food.

It is of importance, in a practical point of view, to be acquainted with the marks by which these troublesome and disagreeable parasites are distinguished, because different methods of destroying them require to be adopted according to their different habits and places of residence. The whole tribe is divided into two sections; the one containing such species as are provided with a tubular sucker, the other, the kinds having the mouth provided with two horny mandibles or jaws. These differences in the structure of the mouth must obviously exercise a great influence on their habits and general modes of procedure.

The first we shall notice, which is one of the most common and troublesome, belongs to the last-mentioned division; it is the *Trichodectes scalaris*. The genus Trichodectes is known by having the antennæ three-jointed; the tarsi with one claw; the head horizontal and scale-like, with the mouth beneath; mandibles strong, tridentate at the apex; the eyes very inconspicuous, and at times invisible. All the species live upon quadrupeds, their food consisting of hair, wool, and exfoliated particles of the epidermis. Their jaws act horizontally, and cut off the hair close by the roots, exactly as if it had been done with a pair of scissors.

FIG. 1.



T. scalaris, *Pediculus bovis*, Linn. *Louse of the Ox*, is about half a line in length, the head and thorax of a bright rust-yellow, the former with two dusky spots in front, and of an obcordate shape; eyes prominent; antennæ pale yellow, the third joint longest and spindle-shaped; abdomen oblong, pale, tawny, finely pubescent, the first six segments with a transverse rust-red or dusky band on the upper half, and a large longitudinal spot of the same colour on each side; the hinder extremity with a large similarly coloured spot; legs pale; the claws nearly straight. (Fig. 1.)

This species is very common on cattle, and for the most part is found about the roots of the hair on the mane.

FIG. 2.

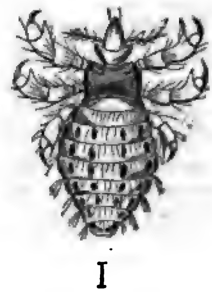
T. equi, *Pediculus equi*, Linn. *Louse of the Horse.*—Nearly one-half larger than the preceding, but in other respects bearing a close resemblance to it. The head and thorax are of a bright chestnut colour; the head somewhat square, with the angles rounded, and much wider than the thorax, having an angular dusky line on each side posteriorly; antennæ pale, thick, the last joint longest, and somewhat club-shaped; abdomen obconical, coloured nearly as in *T. scalaris;* legs pale, thick, and strong, the tibiæ abruptly clavate; the tarsi short. (Fig. 2.)

Common on the horse and ass, multiplying to a great extent when these animals are afflicted with certain kinds of diseases. It is said to be most plentiful when the animals are fresh from pasture. Several other species belonging to this genus are found on different animals. One occurs on the sheep, (*T. sphærocephalus,*) another (*T. longicornis*) on the fallow-deer, and a third (*T. similis*) on the red-deer; but they never appear to increase on these animals to an injurious extent.

Hæmatopinus eurysternus. Louse of the Ox.—In this genus the mouth is formed for sucking, there being a short tube projecting from the mouth; the antennæ are five-jointed; the thorax distinctily separated from the abdomen, and much narrower, shorter, and broader than the head; abdomen large, depressed, commonly oval, consisting of eight or nine segments; legs formed for climbing, very thick and stong; claws single and incurved. Perhaps the most plentiful of all the species which infest cattle

is that named above. The head, which is of a chestnut colour, is somewhat triangular, rounded behind; the thorax dull chestnut, nearly square, with a spiracle and an impressed line on each side; abdomen greyish-white, or ochrey, smooth and shining, with four longitudinal rows of dusky horny excrescences, the last segment with two black curved marks; legs chestnut, the extremity of the claws black. Length from 1 to $1\frac{1}{2}$ lines. (Fig. 3.)

FIG. 3.



It is this species, for the most part, that proves so troublesome to stalled oxen. It frequents chiefly the mane and shoulders. Being a suctorial insect, it cannot directly strip off the hair, but, by abstracting the jucies by which the bulb or root of the hair is nourished, it makes it more liable to fall off, and the irritation its punctures occasion causes the animals to rub themselves till the skin is quite bare. Mr Denny remarks that the young are much more agile than the mature insect, and differ in nothing except a want of proportion, the limbs being much thicker as compared with the bulk of the body than when adult. Another species, somewhat similar in appearance, (*H. vituli*,) occurs in the calf, but it does not appear to be common.

Hæmatopinus suis. Pediculus suis, Linn. *Louse of the Swine.*—Head and thorax dusky rust-colour, the former somewhat pear-shaped, with an angular black line at the apex, and one on each side before the eyes; hinder angles of the thorax acute, each side with a distinct spiracle; abdomen large, flat, and oval; of a membranaceous consistency, bluish or yellowish ash colour, sometimes nearly white; the second and five following segments with a black horny excrescence on each side surrounding the spiracles; the hinder segment with a black patch on each side; legs pale, long, and thick. Length $1\frac{1}{4}$ to $1\frac{3}{4}$ lines. (Fig. 4.)

FIG. 4.

This species is found, for the most part, in great plenty on all kinds of swine, although certain breeds appear to be infested with them more than others. Mr Denny states that it does not appear to be so generally spread as might be expected from the dirty hahits of the animals.

It most frequently occurs (he says) on those fresh imported from the Sister Isle. It was many months before I could obtain a single example. I had applied to both farmers and pig butchers neither of whom seemed to approve of the idea which I had

conceived of their pigs being *lousy*, but referred me to those of the Emerald Isle as being sure to gratify my wishes—(forgetting, I suspect, that the Irish pigs come to this market to meet English buyers.) I accordingly visited a colony just arrived, when I certainly met with a ready supply; but here they were confined almost entirely to lean animals, and wherever I found a pig fat or healthy, no game were to be seen. In walking, this species uses the claw and tibial tooth with great facility (which act as finger and thumb) in taking hold of a single hair. The male is much smaller, with the abdomen shorter, sub-orbicular, and the segments lobate; the egg or nit is ¾ of a line in length, of a cream colour, and elegantly shagreened, oblong, and slightly acuminated, surrounded by a lid, which, when the young insect is ready to emerge, splits circularly, or, as a botanist would say, has a circumcisile dehiscence.

H. asini, *Pediculus asini*, Linn. *Louse of the Ass.*—About the size of the preceding species; colour rust-yellow on the head and thorax, the former very long, narrow anteriorly, with two black patches on each side near the apex; abdomen large and ovate, pale-yellowish white, wrinkled and hairy, with a dusky horny excrescence surrounding each spiracle; the last segment with a large angular black spot on each side; legs short and thick, the colour of the thorax. Length 1 to 1¾ lines.

This parasite is very plentiful on the ass, particularly about the head and mane, but, probably, owing to the thick skin of the animal, it does not appear to occasion it much annoyance. The rabbit is also infested with a peculiar species of *Hæmatopinus*, and likewise the dog, but they seldom increase to any great extent.

These are the principal pedicular parasites which are most annoying to our most useful quadrupeds. Birds of almost every kind, whether wild or tame, have also their peculiar inhabitants of this class; not a few of them are infested by several different kinds. This is the case more especially with the common domestic fowl, which has at least five species appropriated to it. Of these, one of the most common, which may be seen running over the hands of those employed in plucking fowls, and which is difficult to brush off, owing to the flatness and smoothness of its body, is the

Menopon pallidum, *Pediculus gallinæ*, Linn.—It is very minute, not exceeding ½ or ¾ of a line in length; the colour pale straw, the surface shining and smooth; head triangular and obtuse, with pitchy spots on each side; antennæ with the fourth joint large and oblong, and terminating in a tuft of hairs; eyes dark; abdomen elongate oval, the segments equal; legs rather thick, the anterior thighs broad and round. The other species which infest poultry are the *Goniodes dissimilis*, a genus remarkable for having, in the males, the third joint of the antennae recurved towards the first, and forming a claw, by which the insect can lay hold of a hair, the barb of a feather, or any other small object; *Goniocotes hologaster*, having the head, thorax, and legs pale yellow, with pitchy black marginal

bands and spots, and the abdomen with pale ash-coloured lateral bands bordered with black. Neither of these two species is common. But the *Lipeurus variabilis*, which may be known by being of a dull white colour margined with black, is very abundant on the domestic fowl, preferring the primary and secondary feathers of the wings, among the webs of which it moves with great celerity.

Two or three different species inhabit the various kinds of pigeon. Of these the most common is *Goniocotes compar*, which has a large head, with produced acute angles behind, from each of which two long bristles project; abdomen white, broad and obovate, the margin all round rusty brown; length from 1 to 1⅓ line. Next to this in frequency, and sometimes still more abundant, is *Lipeurus baculus*, the body of which is very narrow and elongated, the head angular and depressed; the abdomen nearly cylindrical, dull yellow-white, with a series of large trapezoidal dusky patches on each side. Few birds, Mr Denny remarks, are so infested with parasites as the *Columbidæ*; besides four species of lice, he has found upon them a large *Ixodes*, a small *Acarus*, and the *Pulex columbæ*; and the Rev. S. Jenyns detected a bug, *Cimex columbarius*, which he has described in the "Annals of Natural History."*

Grouse, and their near ally, the common partridge, are far from being exempted from these unwelcome visitors; and in unhealthy seasons, when the former are in a debilitated state, the attacks of the parasites tend greatly to retard or prevent their recovery. *Goniodes tetraonis* infests both the black-cock and common grouse, and is, for the most part, very common. The form of the head resembles that of *Goniocotes compar*; colour of the head and thorax pale chestnut yellow; abdomen pale yellowish-white, obovate, lateral margin bright chestnut, each segment, except the antepenultimate, with a pitchy sutural, somewhat club-shaped, abbreviated band. Length about a line; the female somewhat larger. *Nirmus cameratus* is also common on the red grouse. It is much smaller than the above, deep chestnut colour and pilose; head short, and somewhat heart-shaped; central band and sutures of the abdomen pale yellow white. The species most frequently observed on the common partridge is *Menopon perdricis*, a very minute insect, not exceeding ⅔ of a line in length, of a dull ochrey yellow, the head large and almost semilunar, with a dusky spot on each side, and a band before each eye; the abdomen broad. A more remarkable looking species, also frequenting this bird, is named *Goniodes dispar*, but it is not of frequent occurrence. One of

* Vol v. p. 242.

the largest known parasites of this class occurs on the peacock. It is *Goniodes falcicornis*, *Pediculus pavonis*, Linn. The female is about 2 lines in length; and the male has the first joint of the antennae with a large tooth on the internal edge; second cylindrical; the apex oblique; third long and recurved; fourth and fifth very small, in the female filiform. This insect may be found after the death of the bird collected in numbers about the base of the beak and crown of the head. *Goniodes stylifer*, which has a considerable general resemblance to the above, is found on the turkey; it is easily recognised by having the hinder angles of the head produced into a sharp projection like a horn.

Many other of our domestic birds, such as geese, ducks, &c., have each a peculiar parasite of this class assigned to them, and there is scarcely any of our wild birds that are without similar assailants. But in such cases, the parasites appear to do little or no injury, and it is unnecessary, therefore, to refer to them more particularly.

In regard to the means best adapted for counteracting the ravages of these parasites, lice on cattle and horses may be destroyed by a plentiful and repeated application of oil, and also by repeated rubbing of mercurial ointment into the affected parts of the skin; but, on using this latter substance, care should be taken not to expose the animal to rain or cold.

ON THE FORMATION OF MANURE-HEAPS AND THE ECONOMIZING OF LIQUID MANURES.

By Mr T. Rowlandson, Liverpool.

Several papers touching this most important topic have appeared in the last two numbers of the Farmers' Magazine. I allude to the translation by Mr G. Law, from Boussingault's "Rurale Economie." *Subjects*—"The Ammoniacal Combinations in Urines, Excrements, and Manures," and "On the Management of the Dung-Heap and the Manufacture of Farm-yard Manure." "The Water contained in Manures. By Cuthbert W. Johnson, Esq., F.R.S.;" and, lastly, "On the Management of Stable-Dung Manure, especially as regards Exposure to Rain. By Dr John Davy." *En passant*, I may remark that the two articles of Boussingault do not convey any new theory or practical suggestions of note—Mr Johnson's paper is a very useful one—Dr John Davy's is, however, of a most important nature, so much so, that I shall extract the paper at length, as it appeared copied from the Edinburgh Philosophical Journal into the Farmer's Maga-

zine for the month of May. In order to justify myself for so doing, I may state that the general observations by the learned Doctor are precisely similar to those I had made some time previous to the appearance of his paper, which will be found to be the case on referring to a paper of mine on the subject of lime, which appeared in the "Journal of Agriculture" for October 1844; in addition to which, Dr Davy has made some analytical investigations, which I have not, under present circumstances, a convenient opportunity of entering into. As, however, his paper perfectly coincides with the opinions I have formerly held on the subject, and the analytical investigations being in their results agreeable to what I have long suspected, is the reason I now incorporate his paper with this in such a wholesale manner. I have thus copiously alluded to the papers above named, as I shall have more or less occasion to recur to them hereafter. The remedies which I intend to propose for some of the evils complained of with respect to the general management of manure-heaps, I am sorry to say, are not as yet of so satisfactory a nature as I could wish. I have no doubt, however, but the difficulties which I shall point out are not of an insurmountable nature. Dr Davy states—

The farm-steadings here (Westmoreland) are commonly on declivities; the dung-heap is usually placed on a declivity, often by the road-side, and, in consequence, after every shower of rain, the water that runs off, percolating through the manure, robs it of some of its most valuable ingredients, especially its soluble salts and soluble animal and vegetable matter, tending to starve the fields and pollute the roads. I have had the curiosity to collect portions of such drainage and subject them to examination; and I now propose to give the results, as they shew in a very marked manner the injurious effect, and how great is the loss to the farmer, in consequence. The first portion collected was from a heap of stable dung, fresh from the stable, just before a heavy fall of rain, the accompaniment of a thunder-storm, nearly an inch falling in three hours. The water which ran from the dung-heap was of the colour of a weak infusion of coffee, of specific gravity 1002 to pure water, or 1000. With the peculiar smell of stable dung, it had a just perceptible smell of ammonia, which was rendered more distinct by the addition of lime. Under the microscope, it was found to contain, beside a fine granular matter, and many minute fibres and scales, particles resembling grains of pollen, and two or three different kinds of animalcules. Evaporated to dryness, it yielded 2.6 per 1000 of brown matter, which deliquesced on exposure to a moist atmosphere; emitted a very faint smell of ammonia when mixed with lime, indicating that, in the process of evaporation, most of the ammoniacal salt had been expelled, and was, therefore, carbonate of ammonia; and, when incinerated, afforded as much as 51.6 per cent. of grey ash—48.4 per cent. of the extract having been destroyed by the fire, which may be considered as animal and vegetable matter. The ash was found to contain the sulphuric, phosphoric, and carbonic acids, and chlorine, with potash, soda, lime, and magnesia, chiefly in the form, it may be inferred, of carbonate of potash, phosphate of lime, sulphate of lime, sulphate of magnesia,* and common salt.

The proportion of the sulphate of lime was large, as was also that of the fixed alkaline salts, whilst that of the phosphate of lime and the magnesian salt was small. The next specimen examined was from a much larger and older dung-heap, after a fall of 1.12 inch of rain in about twelve hours. The fluid was of a darker brown than the preceding, very similar in its appearance under the microscope, of higher

* Querv. Would not the magnesia be found as a phosphate or ammonia phosphate? J. F. J.

specific gravity, viz. 1008, and yet less rich in ammoniacal salt; for, when mixed with lime, it gave only a very faint smell of ammonia; and its extract obtained by evaporation, when mixed with lime, had no smell of the volatile alkali.

It yielded, on evaporation, 10.4 per 1000 solid matter, similar generally to that obtained from the first portion in its qualities—abounding, in like manner, in salts, and those of the same description. The third specimen collected for examination was from the same dung-heap, after a fall of 2.79 inches of rain in twenty-four hours. It differed so little from the preceding that it is not necessary to describe it particularly. As might have been expected, it was more dilute, its specific gravity being 1004. The last specimen I shall notice was one procured from the same dung-heap, after four days of dry weather following the heavy rain last mentioned. It was oozing out slowly in small quantity; was of a dark brown hue, nearly transparent, and almost destitute of smell. Under the microscope it exhibited a few particles and fibres, a very few minute crystals, without any animalcules. I had expected to have found it a concentrated infusion of the dung-heap, and, as such, of high specific gravity. But it was otherwise. Its specific gravity exceeded very little that of the preceding, and was less than that of the second portion, being only 1005, leading to the conclusion that the manure was nearly exhausted of its soluble matter. The weather, during the four days without rain, was comparatively cold for the season, (it was in September,) with a northerly wind, the thermometer, even by day, below 58 degrees, and at night once or twice approaching the freezing point. This low temperature must have checked or put a stop to fermentation, which, in its turn, might have prevented the further formation of soluble matter. The infusion mixed with lime indicated the presence of ammoniacal salts; it emitted a pretty strong smell of ammonia; and, judging from the effects of other reagents, its composition was very similar to that of the preceding portions. It probably contained a larger proportion of vegetable matter, humus and humic acids, than the earlier drainings: it gave a very copious precipitate with the acetate of lead.* The bearing and application of these results hardly require to be pointed out. As the drainage of the dung-heap exposed to rain contains some of the best, the chief ingredients of active manure, (excepting always the insoluble phosphates,) it follows that the more the dung is exposed—the more it is subjected to the washing and percolation of rain-water—the greater must be its loss, the poorer and more exhausted it must become; and that shelter from rain is essential as a preventive—such a shelter as only can be well secured by a shed.

The rational objects to be obtained in preparing manures in a proper manner are, in the first place, to preserve and collect all matters containing either the organic or inorganic constituents of the crops which we are about to raise; and, 2*dly*, if the matters so collected are in such a state as not to be immediately available as food for plants, to render them so by artificial means. The course usually pursued for the first object is to collect all the excreta (usually mixed with straw) voided by the animals in the cattle-sheds, sties, stables, and straw-yards, throwing the whole into a heap, and leaving it in that state until carted into the field. Generally speaking, little care is taken to preserve the urine voided by the cattle, &c., except that which is absorbed by the straw. Much has been written with respect to the second object, such as turning over the heaps periodically, in order to promote a greater and more equal fermentation. This plan has

* This might be supposed to indicate the presence of chlorine, which probably does exist in minute proportion; but, as I have already shewn in my article on lime, when a solution of lead is poured into a solution of humate of potash, a copious precipitate is yielded, leaving a colourless solution, although no chlorine be present.—T. R.

had both strenuous advocates and adversaries. Amongst the latter is Boussingault, who states:—"From what has now been said, it will be understood how destructive to good manure is the custom which obtains in certain countries of turning dung-heaps frequently—of airing them, as it were, in order to hasten their decomposition. Treated in this way, stable litter, &c., does, in fact, decompose much more rapidly; but it does so, and I own I do not myself clearly perceive the object proposed by it, at the expense of the quality; for it is very evident that the volatile principles must be dissipated and lost in the same proportion as their points of contact with the air are multiplied." I am inclined to doubt that so serious a dissipation of the volatile principles (ammonia) of manure takes place in consequence of the turning over of manure-heaps as is here described, and am more inclined to agree with the advocates of old fermented manure, that the loss sustained mainly consists of carbonic acid and water; in fact, Boussingault admits, on the authority of Thaer, that air, collected from the surface of a dung-heap undergoing moderate fermentation, does not contain much more carbonic acid than that which is taken from the mass of the atmosphere. Neither does a vessel containing nitric acid, when placed upon the fermenting mass, produce those dense white vapours which are a certain indication of the presence of ammonia. The decay of vegetable fibre in preparing manure is of great consequence for two reasons, viz., it prepares the straw, so that it can be easily broken by the fork or cut by the spade, and is easier to work into the ground by the plough, whilst at the same time the inorganic constituents of the straw, &c., are set free. The due fermentation, therefore, of the whole mass constituting a dung-heap is of primary importance. In accomplishing this, some circumspection is required; for if allowed to acquire too high a temperature, the mass becomes what is commonly termed firefanged, or sometimes even catches fire; in either case, only the inorganic constituents remain. I may here remark that this circumstance of firefanging is conclusive evidence against the truth of the theory that we have *only* to place upon our fields the inorganic constituents of the crops which we draw from them, in order to produce perpetual fertility, otherwise firefanging our dung-heaps would be a benefit rather than an injury, but all practical farmers know that the contrary is the case, the opposite circumstance, the non-production of sufficient heat, is attended with the disadvantage of leaving the straw in a tough state, so as not to be easily workable.

I shall only at present briefly notice what appears to be the general opinion—it is borne out by the authority of the most able writers, and which perfectly agrees with my own experience—

viz., that, in the preparation of the manure-heap, too great care cannot be taken to most intimately mix together the produce of stables, cattle-sheds, sties, &c., as this mixture is always found to produce that slow but perfect fermentation most advantageous to the objects of the farmer. This might well be expected, as horse manure is well known to be prone, especially in hot weather, to become exceedingly hot, and frequently, if particular care is not taken, fire-fanged, whilst the dung from the cattle-sheds, on the contrary, is noted as being *cold;* in other words, not prone to ferment. I strongly suspect that the reason of this difference arises from the circumstance that the fluid and solid excrements of the horse contain a much larger amount of nitrogenous compounds than those of horned cattle, and, from their more complex composition, give rise to a more rapid and intense decomposition. Although the volatile alkali (ammonia) abounds more in the excrements of the horse, the mineral and vegetable alkalis (soda and potash) are found in greater abundance in those of horned cattle. I wish this circumstance to be remembered, as it is of some importance to the consideration of the subject. I quite agree with Dr Davy that sheds are indispensable for the due preparation of farm-yard manure, as they would be the means of keeping off the intense heats of summer and the rains of all parts of the year. It cannot be a matter of slight consequence that the surface of a dung-heap should be kept at 90° in the shade, or 120° in the sun for days together; and, with respect to rain, I think I shall clearly shew that every drop which falls, and afterwards exudes from a dung-heap, robs it of some of its fertilizing ingredients. Experiments made by myself shew clearly that the first oozings from a dung-heap contain the largest amount of its inorganic constituents and the greatest quantity of ammonia. I allude to the liquid running from a heap in its fresh and unfermented state. I may, however, remark that a considerable portion of the salts appear always in this state to be in the state of carbonates, as, on the introduction of a little acid, a tolerably copious disengagement of gas takes place, which I have no doubt, though I did not test it for the purpose, is the carbonic acid gas. The same liquid allowed to stand a few days ceased to effervesce, and sulphuretted hydrogen was evolved pretty freely, evincing that the decomposition of the sulphates was taking place. Lime-water and the salts of lime only slightly discoloured it, precipitating a small amount of dirty-coloured sediment. The drainings from a manure-heap, especially if it consists wholly or principally of horse dung, when fermented for a few days, and collected after a shower of rain, possess a dark brown appearance, similar to that described by Dr Davy, and if allowed some time to settle, will become tolerably and sometimes perfectly clear; when such

is the case, and it takes place in the *course* of the fermentation of *all* manure-heaps, it is an indication that, in the process of decay, humic acid has been formed, which, combining with the ammonia or fixed alkalis, exude in the state of brown-coloured humates. I may venture to affirm that one-third of the value of our manure-heaps is lost in this manner. If we investigate the phenomenon attendant on the fermentation of a manure-heap, we will find that humic acid must be produced during the decay of woody fibre, with the simultaneous formation of carbonic acid and water, and the disengagement of the mineral alkalis, which immediately combine with the humic acid, forming humates. The latter, being exceedingly soluble, are carried off by the first shower of rain which falls. As this process is being continually repeated, it follows, as a matter of course, that the greater portion of the most valuable parts of the manure-heap is entirely lost to the farmer. It may be said, if such is the case, a manure-heap so exposed to the weather must, during the course of a winter's rain, be robbed of the whole of its most valuable contents. Such would undoubtedly be the fact were it not for one counteracting circumstance, viz., the insoluble humates; and some combinations of carbon with hydrogen and oxygen,* which do not combine with alkalis to form soluble salts, have the property of retaining a great portion of other salts and various gases.† Were it not for this circumstance, our manure-heaps, as ordinarily prepared, would become destitute of all their fertilizing ingredients, with the exception of the almost insoluble phosphates of lime, magnesia, and the sulphate of lime. It is quite true that the fermentation of manure-heaps cannot proceed without the aid of moisture, but ordinary formed farm-yard manure contains sufficient moisture of itself, when taken out of the offices, adequate to the fermentation which is desirable, provided it is not so exposed to the action of the sun and atmosphere as to cause too great an evaporation. A shed would remedy this evil. Moisture is, however, not the only circumstance required to the due fermentation of a manure-heap, oxygen must also be present, which can only be derived from the atmosphere. If a manure-heap were surrounded by an atmosphere of carbonic acid gas, no fermentation would take place whatever degree of moisture was present, oxygen being equally important with moisture and heat. It follows that, if we can devise any means of limiting the admission of the atmosphere, we shall in some degree obtain a control over

* Frequently called coal of humus, but the prime constituent of which I cannot determine at present. It is certainly insoluble in acids and alkalis.

† I am strongly induced to believe that the humate of lime has the property of retaining many volumes of gases and a great proportion of the various salts.

the fermentation of the heap; and the evil arising from the presence of humic acid, which is *certain to be formed*, can easily be remedied. The fermentation of manure-heaps depending upon the presence of heat, moisture, and the atmosphere, the skilful farmer will avail himself of the means in his power to promote or retard fermentation, by dispensing with, or admitting, one or other of these agents as the case may require. This can be done in several ways, to enumerate and explain which, would, however, require more space than the compass of this paper will admit. I shall therefore confine my remarks to some general rules, and to modes of proceeding which will fall within the capacity of the humblest cottager.

The free admission of the atmosphere is one of the principal causes of excess of fermentation, and Boussingault, although he does not state this to be the *cause*, admits that "it is of much importance that the heap be pretty solid, in order to prevent too great a rise of temperature and too rapid a fermentation, which is always injurious. At Buhelbronn, our dung-heap is so firmly trodden down in the course of its accumulation, by the feet of the workmen, that a loaded waggon drawn by four horses can be taken across it without very great difficulty." Notwithstanding what has just been stated, many able writers on this matter have asserted that tramping down manure is injurious. It is obvious that each party is right according to circumstances. If a manure-heap is required for almost immediate use, nothing is more certain than that a free admission of the atmosphere is necessary, in order to promote free and rapid fermentation; but this is done at the expense of a considerable escape of its volatile contents. On the other hand, if intended to lie for some months, (as is frequently the case,) pressure and consequent absence of a great portion of atmospheric air is advantageous, fermentation being by this means retarded, and generally proceeds more equally throughout the mass.

It is matter of considerable importance to the farmer, at some periods of the year, that he should have the means of preparing his fresh into well fermented manure. In all cases, I most strenuously advocate that moisture of every description should be kept from a manure-heap, with the exception of the drainings of the offices, which ought to be conveyed to the heap or pit by tunnels, (there are tiles manufactured for the purpose,) and no water should be permitted to enter, unless it be thrown on for some special purpose by the proprietor. By restricting the admission of the air, we have a direct command over the fermentation of the manure-heap, and this can only be accomplished by placing the manure in pits. If they have a rough covering, so much the better. The usual shape of a manure-heap is that of a cube or parallelopipedon, each being a figure of six sides, five of

which are exposed to the influence of the atmosphere, the bottom only not being surrounded by it. By the use of pits we shall completely reverse this order, one side, the top, only being exposed to the atmosphere, and that also the side, from the altered circumstances of the heap, by which the atmosphere will have the greatest difficulty in penetrating. In fact, from the absence of draught, fresh volumes of the atmosphere will only penetrate by means of pressure. In other words, to fill up the vacuum caused by the formation of carbonic acid and water, instead of, as according to the ordinary practice, freely permeating the whole mass, and, by this means, causing the disengagement of additional caloric, which, reacting on the mass, a more rapid fermentation ensues, and fire-fanging is the frequent consequence.

The mode in which manure-heaps are usually formed is that exactly the best adapted to dissipate its most fertilizing contents, the soluble, but non-volatile, contents being carried away through the effects of rain, whilst a tolerably free draught of air exists throughout the mass, as the atmosphere undoubtedly penetrates it through the sides, in consequence of the slight superior pressure there, and also through the circumstance that the carbonic acid, water, &c., invariably escaping through the top, causes an ascending current unfavourable to the admission of the atmosphere at the top, but decidedly favourable to a current passing in through the sides, thus causing a draught constantly going forward from the sides through the top, or precisely that mode most favourable for the dissipation of its valuable volatile contents; whereas, if we place the manure in pits, all access of air is prevented, except such as will be required by the formation of the vacuum previously described. I never carried the plan I now propose into execution, having followed the usual course, but I have observed in this town, (Liverpool,) where, on account of the high price of land, the greatest economy of superficial space is required in forming the manure-heaps of the large horse and cattle proprietors, the general practice is to form a square pit about ten or eleven feet deep, to deposit the manure in, of exactly that form which will contain the largest superficies with the smallest circumference. No form could be desired better for the purpose of containing the greatest bulk in the smallest compass, and at the same time presenting so small a surface for escape of the caloric evolved during fermentation, yet an instance of fire-fanging is never known *in these pits.* It sometimes, however, happens that, from the absence of a demand for manure, or other causes, these pits become filled above the top,* sometimes to the height of eight or ten feet. On such

* They are generally walled, the walls raised about three feet above the level of the yard, and usually placed in some corner, or other place the least incommodious. In some places, however, the whole yard is excavated and boarded over; it was in one of the latter places that I saw the best fermented manure I ever witnessed.

occasions I have ascertained that it is sometimes requisite to obtain an immediate removal of the upper portion, or turn it over at considerable trouble, in order to prevent firing. It is worthy of particular observation also, that where the manure is heaped up above the level of the pits, and consequently one or more sides are exposed to the influence of the atmosphere, in such cases the manure so accumulated never has the same appearance as old fermented manure. This cannot be owing to the shorter period that has elapsed from the formation of the superior portion exposed to the atmosphere, as I have been careful to observe and mark the time requisite to produce the certain appearance of well-fermented manure placed in pits, and such as are raised above them, and more subject to the influence of the atmosphere.

The best formed manure, in the shortest period, that I ever witnessed, was that of the pit belonging to an extensive cart proprietor. In the stable I now allude to there were usually about thirty horses, the pit was formed in the yard, and covered over by thick planks, part of which were covered with earth and paved, only a few boards remaining loose for the convenience of removing the manure, with a trap for the purpose of putting the manure into the pit. The yard was roofed in, so that no extraneous moisture could be admitted. So circumstanced, I ascertained that, in summer, the whole of this mass, except the accumulations of the last few days, was converted into a well-fermented workable state in the course of ten days to a fortnight; in winter it took about three weeks to accomplish the same. It might be supposed, from the above description, that serious annoyance would be felt at the escape of ammonia, and that a most extraordinary heat would be generated; but such was not the case. I have been present when a pit so circumstanced was being removed, but the heat was not near so intense as that which is frequently observed in ordinary farm-yard dung-heaps; but, unlike the latter, it was not entirely confined to the centre, whilst the sides were comparatively cool, but it pervaded the whole mass in an equal degree; no perceptible smell of ammonia was perceived, but a very copious amount of aqueous vapour was evolved in the course of its removal, so much so, that you could not at times see the workmen in the pit who were in the act of removing the manure. These facts are strongly confirmatory of the correctness of my opinion that the mismanagement of the fermentation of our manure-heaps arises from the unlimited access of the atmosphere, and strikingly illustrate the advantages to be derived by casting the exuvia, &c., of farm offices into pits, instead of throwing it into heaps in the ordinary manner. Another advantage to be derived by using pits is, that, in winter, the caloric arising from the fermentation of the heap would not be dissipated so speedily as it is under the present

system, when surrounded by a cold, perhaps frosty, atmosphere. It is so well known that manure-heaps formed in winter do not ferment equally, or scarcely at all, that it has given rise to the axiom that one load of manure formed in summer is worth two formed in winter. I need not enter into any details as to the mode of forming such pits. Every sensible farmer, if convinced of the correctness of the theory, will easily select the fittest place, and invent the best mode, under his own peculiar circumstances, for constructing them. As a general rule, they ought to be impervious; if the soil will permit it, so much the better, if not, they ought to be made so. A rough covering would be an improvement, for the reasons previously stated. Pits formed in the manner described would convert the average mixture of horse and cattle manure into excellent fermented manure in the course of three weeks or a month in summer, and in winter in the course of six or eight weeks—advantages which must be most palpable to every scientific farmer; and this will be accomplished without any loss worth mentioning of its volatile fertilizing contents.

The careful farmer will always be mindful that every matter which can be collected about his farm, such as weeds, twitch, or squitch, &c., are collected and added to his manure-heap. Such will find that the mode proposed has decided advantages over the ordinary method; whilst on this subject I may remark that, a few years ago, whilst fallowing a field overrun with weeds, twitch, &c., I had the weeds, after being well harrowed, carted to the yard, and placed between two layers of fresh horse manure. As it was my intention to apply the whole as manure to potatoes, I thought it would be advantageous to throw a little nitrate of soda on the weeds, &c. This was done, and a strong fermentation took place, and the whole of the weeds were converted, within ten days, into a rich black mass. All of the work people attributed this to the saltpetre, as they called it, being used. I am inclined to think that the heat generated by the horse manure caused the weeds rapidly to decompose—and as matters in a state of decay have the property of absorbing oxygen from all other matters with which they come in contact, it is probable that a portion of the nitric acid of the nitrate of soda was decomposed. A very heavy shower of rain fell between the time of mixing the weeds, &c., and the period of removing them to the fields, and I never remarked such a quantity of deep-coloured fluid to exude from so small a mass of manure, evincing that a great quantity of humic acid was formed, which was probably combined with the soda of the nitrate and ammonia of the decomposed horse manure, and not improbably ammonia formed by the decomposition of the nitric acid. I now merely state the facts as I observed them, and shall be happy if they can in any way be serviceable to others; this much is quite certain, the

weeds were speedily converted into an apparently good manure, the value of which I did not attempt to determine at the time, and I have not since repeated the experiment. On a large farm, in some years, no inconsiderable amount of dead animals are inconsiderately thrown aside or given to the dogs, which, if cut into pieces, and placed in pits, such as described, would form a valuable addition to our manure-heaps; and, from observation, I am convinced that, if so placed, would occasion much less annoyance than is felt by their putrefying in the open air. However we may cause the manure of our farms to be prepared, under all circumstances a large amount of humic acid will be formed. I will not now enter into a disquisition as to the reason how the humic acid, which forms a soluble salt with several of the alkalis, becomes, in the course of a lengthened fermentation, converted into a black substance, insoluble in either alkalis or acids. The result of my observations amount to this, that in heaps, as usually formed with free access of the atmosphere, a larger amount of humic acid, soluble in alkalis, is formed than when the manure is placed in pits and access of the atmosphere is limited. In the latter case, some humic acid is formed; in both cases the humic acid is in the same state as that which is found in barren peat mosses, as I have determined by repeated experiments. As I have shewn in my article on lime, humic acid has a strong affinity to combine with the alkalis, potash, soda, and ammonia, which combination in manure-heaps forms the brown-coloured solution which is observed running from them after rain. It is perfectly obvious, therefore, that every drop of this brown-coloured liquid which oozes from a manure-heap contains in combination one or other of the above-named alkalis, two of which, potash and ammonia, are of so much importance as fertilizers. The mode I have suggested, viz. placing the manure in pits, may be said to remedy this evil, as, at all events, it will prevent the liquid from running away. It is of no importance, however, preserving the liquid of manure-heaps in the state described, as I have repeatedly found that no beneficial effects are derived from the use of it. Lime and its salts, however, have the property of combining, the former with humic acid, and setting the previously combined alkali free; the latter, by double decomposition, forms insoluble humate of lime, and the soluble muriate or sulphate of the alkali, as the case may be. Lime-water, or milk of lime, if poured on a fermenting heap of manure, will combine with the humic acid, but there are two circumstances which prevent this operation being so perfectly beneficial to the farmer as it might be supposed. In the first place, the lime is apt to combine with the carbonic acid gas evolved during the fermentation of the heap, and form the carbonate which is insoluble, and only slightly so

where an excess of carbonic acid is present. This condition is found in fermenting manure; but as it is so sparingly so, viz. one part of bicarbonate of lime in 1500 parts of water, its beneficial action in neutralizing the injurious action of humic acid is much deteriorated. Were, however, the power of lime-water to destroy the obnoxious effects of free humic acid in dung-heaps as complete as though no carbonic acid was present to retard its influence, another cause operates to prevent the remedy being so desirable as it otherwise might be. When humic acid, combined with ammonia, is decomposed by lime ammonia is immediately set free, which is speedily converted into the carbonate. Both of these being volatile substances, there is danger of this important nitrogenous matter being dissipated by evaporation. In experiments made with humate of ammonia decomposed by lime-water, I have not discovered the well-known smell of ammonia, which I attribute to the fact that humate of lime has the power of absorbing ammonia in a remarkable degree.

I state these circumstances now by way of caution. It occurred to me that dissolved bones in muriatic acid would be the fittest mode of counteracting the injurious effects arising from the presence of free humic acid, or the soluble humates which exist *in all* manure-heaps. I found, however, one counteracting circumstance, viz. that the mixture was extremely apt to gelatinize. If, therefore, an economical mode could be discovered (and I see no difficulty in the way) of extracting the fat and gelatine from bones previously to mixing them with muriatic acid, and also converting the gelatine to a profitable use,* this would be the best mode of fixing ammonia and rendering humic acid innoxious.

Experiments made with special manures seem to prove that the sulphate of ammonia has greater fertilizing qualities than the muriate: and gypsum might be deemed for this service more economical and serviceable; but gypsum is very insoluble, and when placed in contact with a soluble humate, becomes immediately surrounded with a thin circumference of humate of lime, which prevents all further action. I therefore recommend on all occasions to use the muriate of lime, or bones dissolved in muriatic acid. Whenever we wish to neutralize the effect of humic acid, the latter would be preferable to any other substance were its gelatinizing effects preventible; and I think this may be accomplished. Free sulphuric acid and muriatic acid have each been recommended to fix the ammonia in manures; but in either case a quantity of humic acid is always set free, which prevents, when it is placed on the field, the beneficial effects which would otherwise be derived from the ammonia which

* Gelatine is used for calico manufacture, and is an excellent glue; but I know of no method which has been described which would, economically to the farmer, make this available, or of easy transport.

descends from the atmosphere in rain. Sulphate of iron has also been recommended, and I am inclined to think that a portion, when gypsum or other sulphates cannot be obtained in sufficient quantity, would act very beneficially. The iron of the sulphate of iron, undoubtedly forms an insoluble humate of iron, as I have repeatedly seen.

By one or more of the preceding methods we are enabled to prevent the escape of the whole of the volatile and fixed salts which form the most valuable components of our manure-heaps—by keeping the same in pits, we prevent the excess of moisture, which frequently contains the richest ingredients (though not in a state adapted to promote the growth of plants) from escaping.

When cattle are fed on green food, a considerable quantity of urine is voided by them, which it is of much importance to the farmer should not be wasted. Urine, on the average, contains 95 per cent. of water, but the remaining 5 per cent. contains more nitrogen than 100 parts of ordinary farm-yard manure, the remainder consisting of the phosphates and sulphates of lime, magnesia, potash, and soda. I have recommended, in a previous part of this paper, that *all* the urine from the offices should be conveyed to the dung pits through tunnels, and no extra moisture should be admitted where cattle fed on green food greatly preponderate in proportional numbers. In house and other fed cattle, it is probable that so large a quantity of moisture being present in the pit will have an injurious tendency. When such is the case, it would be easy to sink a small tank or well adjacent to the dung-pit, and connected by a tunnel, the tank of course being somewhat below the level of the bottom of the dung-pit. In this mode, the liquid may be allowed to putrefy, in which state it is always found more efficacious, and would, at the same time, serve to moisten the dung-pit, if such should at any time be deemed necessary. Were dissolved bones used, as I have previously described, to neutralize the humic acid and humates, it could not fail to render the liquid oozing from such pits most valuable. These are merely suggestions thrown out for practical persons to avail themselves of; for, if such are convinced of the correctness of the general principle, they will easily, with only a slight exercise of ingenuity, devise means of carrying out the plan in a practical manner.

To those who have not the conveniences for collecting or distributing liquid manures, I beg leave to offer the following suggestions—Whenever peat earth is available, let a quantity of this be made into compost with lime, about twenty loads of peat to one of lime, and throw this compost into the bottom of the pits until it is about one or two feet thick, as may be thought most judicious; in the absence of peat, ditch scrapings might be used. In the agriculture of this county, liquid manure is best

applied to grass lands, or young corn, immediately after it has been rolled, and ought, if possible, to be applied in dropping or dull weather. In conclusion, I may observe, that I cordially agree with C. W. Johnson, Esq., that "the watery matters, to which in England the name of liquid manures is very often erroneously applied, consist of hardly anything else but a little discoloured water." The remark is true, and is doubtless the reason why liquid manures have so little reputation in this country.

I cannot conclude this paper without adverting to the fact that no writer has ever investigated the reasons why, under certain circumstances, humic acid is formed, as in peat mosses, whilst on fertile lands, which yield considerably greater amounts of vegetable matters on equal spaces annually, vegetable matter or humic acid does not accumulate. Whilst investigating the action of alkalis with humic acid, I was rather struck with some changes that took place, which I think will throw some light on the subject, and which I intended to reserve for an article on the formation of soils.

A paragraph has gone the round of the papers, to the effect that Liebig has discovered a mineral substance which, mixed with guano, will produce the most surprising fertility; and it states farther, that a company has been formed, with upwards of £100,000 capital, to carry the invention into effect. I know of no mineral, in the present state of chemical knowledge, which is likely to produce such powerful effects as described, unless it be one containing potash in abundance. Fuch has stated that he has obtained as much as 18 or 20 per cent. of potash from the potash felspars. If some of the felspars, which are much mixed with pyrites and pyritous shales, were burned, and then slaked, very probably decomposition might take place—sulphate of potash, potash, and oxide of iron being produced. The shales of our coal measures are said to contain considerable quantities of potash. Free potash, or its carbonate, applied to a dung-pit, formed as I have stated, and the humic acid of which should be neutralized by the use of bones dissolved in muriatic acid, would produce fertilizing effects in the most surprising degree. It is the constant waste of the potash from our fields that they to so great a degree owe their exhausted nature. I should feel obliged if any one of the readers of this Journal could conveniently forward me a few specimens of felspathic potash minerals from places where these are produced in abundance. If an economical mode could be discovered of extracting the potash, or converting these minerals into such compounds as might be available to the farmer, it would be one of the greatest boons that could be conferred on the British agriculturist.*

* To enable any of our readers to meet this request, we may mention that Mr Rowlandson's address is 59, St Anne's Street, Liverpool.—EDITOR.

Since the preceding remarks were forwarded for publication, a small pamphlet has been published by Messrs Muspratt & Co. of Liverpool, entitled, "An Address to the Agriculturists of Great Britain, explaining the Principles and Use of his Artificial Manure, by Professor Justus Liebig." In Muspratt & Co.'s preface to the above-named pamphlet it is stated—"This eminent chemist, whose name is attached to the succeeding address, has discovered certain compounds, &c. which are of such a nature, that different states of moisture in the atmosphere, or different localities, will not diminish their efficacy." In Liebig's pamphlet it is stated—"I have found means to give to every *soluble ingredient* of manure, by its combinations with others, any degree of solubility without altering its effect on vegetation. I give, or instance, the alkalis in such a state as not to be more soluble than gypsum." "The mixture of the manures has been adapted to the mean quantity of rain in this country. The manure which is used in summer *has* a greater degree of solubility than that used in winter."

On a subject which I have both privately and publicly endeavoured to impress the importance on the agricultural interest, viz. the economy of matters containing potash, he (Liebig) states, "During my excursions in England, I have repeatedly directed the attention of the agriculturists, as Messrs Pusey and Miles will perhaps recollect, to the necessity of supplying the alkalis, and not merely the phosphates," &c. On this point he judiciously observes—taking the importation of bones for the last 10 years at 1,000,000 of tons, in which phosphoric acid is supplied in sufficient quantity for 25,000,000 tons of wheat—to have increased the fertility of the fields in the right proportion, 800,000 tons of potash ought to have been added to the 1,000,000 of tons of bones in a suitable form. No new principle appears to be developed in the pamphlet except it be that of rendering the alkaline carbonates to a certain extent insoluble. I have previously stated my suspicion that it is probable some of the insoluble humates tend in some degree to render the soluble alkaline carbonates insoluble. Whatever the principles may be, (and they are stated to be secured by patent,) it is evident, from the pamphlet alluded to, that such principles can be applied to the prevention of the enormous waste of potash and ammonia which annually takes place from our ordinary formed manure-heaps. For a supply of potash allusion is made in the pamphlet to the felspathic minerals.

The writer of this conceives that the main features of this patent manure consist in judicious combinations of the principles set forth in this paper and in his previous one on lime.

LETTERS ON SCOTTISH AGRICULTURE.—No. III.*

To John J. Burnet, Esq. of Gadgirth.

My Dear Sir,—To one so well acquainted with the agriculture of the south-western part of Scotland as you are, I should be afraid to address the present letter did I intend to enter into any minute details regarding its practical husbandry. The remarks I propose to make, however, are of that general character which, while they lay me less open to your criticism as a practical man, will prove interesting to you as a friend of agricultural improvement.

It was in August last (1844) that I passed through Ayrshire, by way of Maybole, Girvan, and Newton-Stewart to Barnbarroch, a few miles beyond Wigton. On turning inland, after leaving Girvan, and getting fairly upon the slate rocks, you will not be surprised that I should have been much struck with the marked difference which presented itself in the agricultural character of the country, with the prevalence of moors and bogs, of apparently defective husbandry, and of crops of corn much less promising than the land will by and by be made to produce. The value of a little geological knowledge comes to be clearly seen when one meets all at once with differences such as this day's journey presented.

You pass an imaginary line, and the husbandry changes, the soil seems more barren, the people more indolent, and their methods more primitive. You ask the reason, and you are told that the climate is unfavourable to profitable culture, and that, where nature repays industry with a scanty reward, the farmer is discouraged, and his husbandry remains unimproved.

But the real meaning and value of this word climate is much elucidated by a knowledge of the geology of the district. From St Abb's Head to the Mull of Galloway, there stretches a broad

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* No. III. *Wigtonshire.*—Soil and climate of the slate country. Difficulty in cultivating it. Influence of man over certain elements of climate. Improvements of Mr Rigby Wason and of Mr Vans Agnew. Lectures at Wigton. Agricultural instruction in our elementary schools. Its importance in aiding the diffusion of sound knowledge. Application of lime in the slate country. Introduction of sea-borne lime—its influence. Proportion of lime found by analysis in the slate rocks. Composition of soils upon these rocks. Influence of steam navigation on the growth of turnips, and on the general husbandry of the district. Lean stock more valuable when fed on the hills. Manufacture of potato starch—its influence on local improvement. Use of the refuse and the washings of the potato. New German method of preparing flour from potatoes. Mr Fleming's experiments on the proportions of starch in different varieties of potato, and on the influence of guano on this proportion. New Danish method of employing potatoes in the feeding of cattle. Use of this method recommended.

zone of slate rocks, over nearly the whole of which similar obstacles to agricultural improvement exist, and a similar stationary or slowly advancing husbandry. But if in the midst of this broad tract of country a patch of limestone, or trap, or of old red sandstone appears, all at once the difficulties of climate appear to vanish, and heaven and earth seem to conspire in rewarding the diligent cultivator of the soil. It is the nature of the rock, therefore, on which the soils rest, and by the decay of which they have generally been formed, that has created, as it were, the climate of the spot—has caused the production of its bogs—has subjected its crops to mildew—and has made its harvests scanty and uncertain. The physical conformation of a country, its latitude and its height above the sea, are beyond the reach of human influences, and, so far as climate is dependant upon these circumstances it is unalterable. But such is not the case with climate in so far as it is dependant upon the nature of the soils and of the rocks on which they rest. These are to a certain extent subject to the dominion of man, and it is in endeavouring to overcome the difficulties which they present, that human energy and perseverance are likely to struggle with success.

But where these difficulties exist man is long in settling. The easier ways to comfort are chosen first, the more favoured spots are cultivated, where a smaller outlay of labour and capital command a quicker and more sure return. Pioneers penetrate, and more daring men here and there settle themselves, in cold and unfriendly places, and their posterity subdue it to the plough; but it is long before capital and skill, and men armed with the resources of higher knowledge, find their way among them, and shew that the natural difficulties which the region presents may be removed by human exertion perseveringly and systematically applied.

Such is the case with the slate country of this part of Scotland. The natural difficulties which beset the practical man are greater here than in the other midland portions of the kingdom. More skill and capital must be applied to its soils, and therefore they are later in being brought into a fertile condition. This consideration should lead us to deal tenderly with the existing culture and cultivators of the country. If we wish to improve both, we must not scatter reproaches, we must sow the seeds of knowledge. In the minds of the rural population of Scotland, these seeds will take easy and extended root.

The day of my journey was dull and rainy, and the appearance of the country became more melancholy as I approached the head waters of the Cree river, which, near Loch Maberny, separate the three adjoining counties of Ayr, Wigton, and Kirkcudbright. I was the better prepared, therefore, to appreciate the enterprise,

the hardihood, I might say, of Mr Rigby Wason, in settling himself in this remote locality, and expending so much capital and energy in improving what to many has appeared so unpromising a tract of country. One ought to greet the improver of such a district with words of counsel and hearty approbation, instead of repressing him by discouragement. The more frequent application to the soil of that energy and enterprise by which our commerce is so successfully promoted, would make difficulties, which daunt and deter the ordinary agriculturist, in a great measure disappear.

Towards Newton-Stewart the surface of the country becomes singularly *humpy*, and the soils in many places very thin. The slate rocks protrude through the surface, and form frequent hillocks, as well as lesser elevations, which, in many places, seem to render impossible the use of the plough. On the whole, however, there are great capabilities throughout this entire district. These capabilities the diffusion of knowledge among the resident population of tenants and proprietors will gradually make known, and, at the same time, the means of developing them. Among the gentlemen whom I had the pleasure of meeting at Mr Vans Agnew's (Barnbarroch) was Colonel Stopford Blair, the owner of a large tract of this improvable country. I have a strong persuasion that, both by his influence and his example, he will endeavour to give a new impulse to improvement in this agriculturally difficult country.

In Mr Vans Agnew I found a zealous improver, and a warm friend of the Agricultural Chemistry Association. His father and uncle greatly improved the estate of Barnbarroch, but they have left him still much to do, and he promises to be a skilful, judicious, and, I hope, *economical* improver. This point of economy—of making improvements pay—is of more consequence in the way of example to those who have rents to make up than any other; and hence the great importance of an attention to accounts on the part of those landlords who desire or expect to be followed by their tenantry in the improvements they wish to introduce.

On two successive days I lectured at Wigton to audiences which were very large, considering that the wheat harvest had already commenced, and that so many were necessarily detained by the duty of superintending the hundreds of reapers it is the custom in this part of the country for individual farmers to engage. Among my audience were several of the neighbouring clergy and schoolmasters; and I hope most of them are enlisted in the cause which you and I have so much at heart—the introduction of agricultural instruction into our elementary schools. Mr Vans Agnew had been present at the examination of the

Larne boys at Glasgow, and is, besides, a member of our Agricultural Education Committee. He warmly supported, therefore, any propositions on this subject which I had the opportunity of making in his neighbourhood, and I hope some good is likely to result to the district from the discussion to which the question is giving rise.

I do not know if I have ever had an opportunity of explaining to you why I am especially anxious for the introduction of this branch of instruction into our elementary schools. We are all interested generally in the matter, from the persuasion that agriculture is to be improved, and, therefore, the country benefited by it. But I am especially so, because I believe it will further, and lighten, and give efficiency and permanence to my own labours.

You know that, as the Officer of the Agricultural Chemistry Association, it is one of my duties to visit different parts of Scotland for the purpose of addressing meetings of agriculturists on the subject of the application of science, especially chemical science, to the improvement of the soil. In one or two lectures I cannot hope to impart a large portion of knowledge upon so wide a subject. My expectation is rather that, by selecting a few striking and intelligible topics, which illustrate the value of this knowledge, I may be able to satisfy them of its importance to practical husbandry, and thus to induce them to take some steps for the purpose of acquiring it—to read certain books, for example, which are within their easy reach.

Now, some few may avail themselves of this latter mode of acquiring knowledge, but the farmers in general are not a reading body, and, therefore, any impression I may make will in most cases be temporary and evanescent.

I am anxious, therefore, to obtain some more permanent hold, to leave some more lasting impression in the districts I may visit, and to which it may never be my fortune to return. In casting about how this hold is to be obtained, it has occurred to me, as it has to others, that the schoolmaster, without any cost to the country, and without interfering in any way with his ordinary duties, may be made the instrument of diffusing this knowledge more universally—of giving a continuous and more copious supply of it in each locality—and thus of raising up a race of future farmers who shall not only possess a large share of that elementary scientific knowledge we are desirous to diffuse, but who shall understand and appreciate its value, and shall be prepared to receive and readily apply those further principles which our researches in the laboratory will hereafter establish. If I address an audience on the subject of agricultural chemistry, and if, at the close of my lecture,

the old bonnetted farmer, with his eye full of intelligence, comes to me and says, " What you have told us is very interesting and useful—I am too old to master it, but I should like my sons to learn it," how can I help turning my eye to the schoolmaster and begging his assistance?* In the sister country, local Colleges, as at Cirencester and York, are in the process of being established for the sons of the better classes of agriculturists. But as in Scotland the great breadth of the land is in the hands of small and humble farmers, whose sons are educated at the parish and other country schools, provision, I think, ought first to be made for the instruction of the masses through the medium of these schools. The wealthier orders, if they value it, will find means of providing instruction for themselves.

One of the largest owners of improvable land in this part of Wigtonshire is the Earl of Galloway, but my time did not permit me to visit either the extensive tract of flat moss which skirts the Cree Water, where it falls into the Bay of Wigton, and upon which the farmers are gradually encroaching, nor the expensive warpings by which his Lordship is gradually converting into valuable land a portion of the wide flat of mud, which is left half dry on each side of the river when the tide retires.

Another object of agricultural interest I wished much to visit is the bank of shells thrown up by the sea on the western shore of Wigton Bay. These shells were formerly employed to a great extent in liming the land, and were among the earliest means by which some of the higher farms in the neigbourhood were brought into successful cultivation. The low price at which sea-borne lime can now be obtained has in a great measure superseded their use.

The history of the application of lime in this district illustrates in a very striking manner the influence which increased facilities of internal and external communication have upon the progress of improvement. This slate country, from its geological character, is one in which lime is peculiarly necessary, but in which it is especially difficult to be obtained. The rocks on which the soils rest, and from which they are in a great measure formed, naturally contain very little lime. Thus seven different specimens collected at different places in the counties of Wigton, Kirkcudbright, and Dumfries, were found in my laboratory to contain of lime respectively in 100 parts—

* You know that age does not easily repress the desire of information among the Scottish yeomen. A schoolmaster from Ayrshire writes thus :—" I have formed two agricultural classes. Among other pupils, I have in my senior class the father, a farmer of sixty, in the junior, his son, a boy of eleven, both learning the same agricultural catechism."

No. 1 contained	7.43	per cent.		No. 5 contained	0.65	per cent.
2	...	0.88	...	6	...	0.50	...
3	...	2.08	...	7	...	0.19	...
4	...	1.34	...				

Thus, in general, the proportion of lime present in these rocks is less than one per cent. Those which, like No. 1, contain considerably more, are streaked by minute white veins of calc-spar, (carbonate of lime,) and these, as they crumble, will form soils in which the proportion of lime will at first be sufficiently large to render them more fertile than the rest. But the rains and springs wash the lime out of the rocks and soils, and carry it down into the hollows and lakes. Hence the source of those limited deposits of bog marl which are here and there met with in these counties, which in former times were carefully sought for, and from which unsparing supplies of marl were imprudently spread upon the immediately adjoining lands.

It is in consequence of this prevailing character of the rocks that no workable limestones are known in the district, and no universally available beds of marl. For want of native lime, therefore, much of the improvable land must have long lain in a state of comparative unproductiveness. The introduction of sea-borne lime at a cheap rate from Cumberland, from the Isle of Man, and from Ireland, first superseded the use of the sea shells and of the bog marl in many localities where they had previously been employed. Its next effect was to improve and bring into arable culture many tracts of lands which had hitherto lain in a state of nature, but which the possession of lime enabled the holders readily to reclaim.

After lime had thus been introduced into the district, and its usefulness ascertained, the money value of good roads began to be experienced. The farmer could afford to cart his lime a certain number of miles inland where roads existed—where there were no roads there were no means of cheap conveyance, and therefore his land, though within a few miles of the harbour, lay unimproved. In this state of things some enterprising landlords began to make roads for their tenantry upon their own estates, and what may still be seen in many parts of Scotland was then generally observable in the counties of Wigton and Kirkcudbright. Where the new road ceased, improvement stopped, and where facilities for easy transport were altogether wanting, moors and stony heaths, and marsh or bog prevailed. The whole of this peninsula is within a comparatively short distance of the coast, so that, if proper means be taken, its agriculture need never languish for want of what the sea can bring to it.

To present you with analytical evidence of the nature of the soils in this district, and of the value of lime to them, I subjoin

the analyses of three soils from one farm on the slate formation. They were made in my laboratory for a member of the association, and one of the questions he put in regard to all of them was, "Are they in want of lime?"

In the barren soil, No. 3, you will see there was no *carbonate* of lime at all, though in the insoluble, gravelly, and stony part, about half a per cent. of lime was contained in the state of *silicate*. This, however, would be set free very slowly, and only as the fragments of rock decayed, so that a very small yearly supply of lime could be liberated from the soil itself, and hence the importance of adding it to the land from a foreign source.

Composition of Soils from Mr Edward M'Gowan *by Castle-Douglas.*

	No. 1. Best Soil.	No. 2. Second best Soil, under draining at present.	No. 3. Barren Soil, 25 years in grass, newly ploughed.
1. By Washing.			
Gravel and Siliceous Stones—of a red colour in No. 3, ...	44	18	80
Clay and fine Sand, ...	56	82	20
	100	100	100
2. By Analysis.			
Organic matter, ...	10.38	10.20	9.44
Alkaline Salts, soluble in water & acid,	0.91	1.49	0.29
Gypsum, (Sulphate of Lime,) . .	0.08	0.08	0.06
Oxide of Iron, ...	5.55	3.71	4.63
Alumina, soluble in acids, . . .	5.46	3.38	3.10
Carbonate of Lime, ...	0.44	0.54	—
Carbonate of Magnesia, ...	1.85	1.17	1.41
Insoluble Siliceous matter, consisting of—			
Alumina, with a little Oxide of Iron,			8.89
Lime, ...	75.43	80.33	0.61
Soda, ...			0.59
Silica, ...			71.19
	100.10	100.90	100.21

Another circumstance of a very interesting kind, in connexion with the agriculture of this district, is the influence which steam navigation has exercised in gradually altering the long-established system of rural husbandry. The breeding and rearing of young stock was, and still is, the principal means by which the majority of *slate*-soil farmers pay their rents. The young animals used to be merely kept alive during the winter months. At two or three years old, they are sold to the drovers, who dispose of them in districts where richer pastures afford a more fattening food. It

was during the universal prevalence of this system that the late Sir William Maxwell attempted in vain to introduce the turnip husbandry. The premium he offered called forth no competitors for several years, and was at last given to a cottager who had cultivated a few turnips in the corner of his garden. Where turnips could not be profitably used, no premiums could force the cultivation of them. The only animal on which the art of fattening was tried thirty years ago was the Martinmas cow, intended for the winter salting-tub.

But steam navigation has effected what premiums failed to do. It has made the use of turnips profitable; and has, in consequence, caused the growth of them to spread amazingly. Liverpool is now an accessible market for *fat* cattle; and hence, instead of selling off all their stock in the lean state, many farmers now raise turnips, and fatten them off upon their own land. I need not tell you to how many other improvements in the breed of cattle and in the cultivation of the soil this growing of roots to be consumed upon the farm is the necessary parent and precursor.* It has already produced marked effects both upon the appearance of the farms and upon the comfort of the farmers.

While on the subject of stock, I may mention a fact which not only throws light upon the kind of good results which are likely to follow from a similar extension of communication by land through our numerous railroads, but which especially shews the necessity of practical, and often even of local knowledge, to the agricultural chemist, if he would carry a practical audience along with him while he is explaining the principles of his science.

In one of my lectures at Wigton on the feeding of stock, I had dwelt upon the importance of warmth and of house shelter, and on the waste of food implied in turning out stock to the cold hills in winter. Give them the same food and keep them under cover, and they will be heavier and in better condition than if fed in the open field. "If this be true," said a Wigtonshire farmer to me, "how comes it that I get a better price in spring for the young stock I turn out to the hills than for those I keep under cover, their food being as nearly as possible the same?" To answer this question, which, if the food were really the same, appeared to imply an error in our theoretical views and in the practical results of other districts, it was necessary to inquire what were the *qualities* in the young lean stock upon which the highest value was placed by the dealers in the district.

* You will find this illustrated in an interesting manner in the number of the *North British Review* published in *August* of this year.

An extensive dealer, who was present, solved the difficulty at once, by stating that he gave this higher price partly because the hill-fed cattle were rougher in the hair and looked larger, but chiefly because they *drove better*. This last reason was a very satisfactory one. It was evidently the interest of the merchant to buy what would come in best condition to the market; and hence it became the interest of the farmer also to raise a hardier stock, which would command a readier sale. The extension of rapid and cheap conveyance by railroads will, no doubt, change this state of things in many of our upland districts. It requires a little reflection to see how these roads should be the means of directly increasing the available food of the country, and, therefore, of enabling it to maintain more people; and yet it clearly must be so if a heavier, though less hardy animal, can be raised from the same weight of vegetable food, and can afterwards be conveyed to the inland market without that loss of substance or of strength which now necessarily takes place.

One other subject I am tempted to draw your attention to, from its connexion with the natural progress of rural industry in this and similar districts of country. You know that in the neighbourhood of large towns, the raising of potatoes is a very profitable branch of farming, and that this arises in part from the circumstance that the great weight of this crop excludes the distant producer of it from entering into successful competition with the suburban farmers. Hence, where good potato lands occur, and goods crops are, or can be, easily raised, at a distance from markets, the tenant is prevented, by the cost of transport, from availing himself, in the greatest degree, of the peculiar qualities of his soil. It is therefore of consequence in such localities to discover a mode of manufacturing the potato into some other commodity of easier transport, and, if posible, of as ready a sale. In the north of Europe, it is a very common thing to attach a distillery to a large farm, for the purpose of working up the potato crop, by converting it into brandy. In our country the farmer cannot adopt this method, but he can convert his potatoes into farina or potato flour. Into this manufacture great improvements have recently been introduced, and the farina is converted into British *tapioca*, into syrup, and other articles, which find a more or less ready market. The waste fibre of the potato, which formerly was considered fit only for manure, is now converted into a wholesome nourishment for cattle, and even the washings of the starch, where skill and economy preside over the process, are collected and employed as a manure. You recollect the fact mentioned to us by your brother-in-law, Mr Binning Home, that these washings, when

allowed to run into the potato drills, had given, near Stirling, a larger crop of potatoes than was yielded by other parts of the same field, to which guano and farm-yard manure had been applied.

The farina, or starch, has hitherto commanded a ready sale in the Liverpool market; and such was the success of one manufactory established in 1843 on the Bay of Wigton, that in 1844 several others were in process of erection, so that the outlet for the potato crop in that locality was greatly increased. And so long as the supply of this farina does not exceed the demand, such manufactories will multiply in the potato-growing districts, and thus the available sources of agricultural profit will be increased. They have already found their way into some of our Highland straths, and both tenant and proprietor have been benefited by the additional value which has thus been given to their healthy growing potato crops.

The progress of this branch of industry illustrates the close connexion which exists between our manufacturing and agricultural prosperity. The principal buyers of the potato starch have hitherto been the calico-printers, and others engaged in the cotton manufactures. On their prosperity depends the demand for this article, and, consequently, all the more remote benefits which our rural districts derive from the demand which this prosperity creates for one of their staple articles of produce. How important, therefore, in every point of view, that these manufactories should flourish!

There is little reason to doubt that new uses and new outlets for the potato will by and by become generally known. The farina is by some bakers mixed, to a certain extent, with their wheaten flour, but there is a prejudice against it, and it is considered in the light of an adulteration. In the form of *tapioca* it is gradually finding a more extended use, and in numerous other forms it is insinuating itself into our daily diet.

In Germany, a method has lately been introduced of making flour from potatoes, which has not, I believe, been tried in this country, but which is recommended as giving a better, a more palatable, and a more abundant article of nourishment than the common process of preparing potato-starch. This method consists in washing the potatoes, cutting them into slices, as we do turnips, steeping these slices for twenty-four hours in water containing one per cent. of sulphuric acid, (oil of vitriol,) drawing off the acid water, washing them several times with pure water, drying them in a stove, and then grinding them in a common corn-mill. The flour thus obtained is pure white, and the refuse siftings or bran seldom exceed five per cent. of the weight of the

dried potatoes. The sulphuric acid in this process extracts the colouring matter of the potato, with certain other substances which would give the flour an unpleasant taste. This flour will not make good bread if used alone—it requires to be mixed with from one-half to one-third of wheaten flour.

In growing potatoes for the manufacture of starch (farina) an attention to various circumstances is necessary in order to secure the largest yield of this substance. The soil, the manure, the variety of potato, its state of ripeness, and the length of time during which it has been kept, affect the quantity of starch it is capable of yielding. I have elsewhere published the results of numerous researches as to these points.* Some unpublished experiments, however, made by our friend Mr Fleming of Barrochan, last year, (1844,) will be of peculiar interest to you, because they were made upon certain varieties of potato which are commonly grown in the west of Scotland, and because they exhibit the action of a manure, guano, now very generally employed in your district. The results of these experiments, which he has communicated to me, are exhibited in the following table :—

Relative Proportions of Starch and Water contained in 100 *lbs. of different varieties of Potatoes manured with Dung, with Guano, and with half Dung and half Guano together.*

Varieties.	Manure Applied.	Starch.	Refuse.	Water.	Remarks.
		lbs.	lbs.	lbs.	
Perth Reds, . .	guano alone.	15.3	14.6	69.9	The potatoes were lifted before they were quite ripe. The starch was made from the whole potatoes, well washed but not scraped. The starch was dried before an open fire, and the refuse at 300° F. in an oven. I found it difficult to get all the parcels of starch to the same degree of dryness.—*W. Fleming.*
... .	half dung, half guano.	15.5	15.2	69.5	
Rough Reds, . .	guano alone.	16.0	18.5	65.5	
... .	dung and guano.	17.1	18.1	64.8	
White Dons, . .	guano alone.	9.0	14.5	76.5	
... .	dung and guano.	10.2	14.9	74.9	
Connaught Cups,	dung alone.	14.5	15.6	70.0	
... .	dung and guano.	14.4	14.3	71.2	
Buffs, ...	dung and guano.	14.8	14.0	71.2	
Berwickshire Blues,	dung and guano.	14.3	15.6	71.0	

There is a great difference, as you will see, in the proportions of starch extracted from these different kinds of potato. The *white dons*, for example, yielded little more than half of what was obtained from the *rough reds*. On the whole, the red potatoes seem to be the best starch-givers, and it appears to make little difference whether guano and dung be employed alone or together in the proportions of half dung and half guano. The difference in the proportion of water between the white dons and the rough reds is very striking, amounting to about 2½ cwt. in the ton.

* See my published *Lectures on Agricultural Chemistry and Geology.*

Such facts as these are of importance both to the starch-maker in buying his potatoes, and to the grower of potatoes who raises them for sale to the manufacturer.

As I have said so much on the subject of potatoes, I may as well describe to you a method which has lately been recommended in Denmark and Norway, for making the patato more available and more profitable in feeding cattle than it has ever hitherto been. You are probably aware that potato-starch can be readily converted into grape-sugar, and that the syrup obtained from it is largely employed for the manufacture of brandy in the north of Europe, and even of the best brandy which comes from France. In the more northern of the French wine-growing provinces it is also mixed with the less sweet varieties of grape-juice, so as to give an additional strength and richness to the wine.

One of the methods by which the potato-starch is converted into grape-sugar is to mix it with one-tenth of its weight of ground malt diffused in water, and to keep the mixture for some hours at a moderate temperature. The starch dissolves, and the liquid becomes sweet from its conversion into grape-sugar. This is the method which M. Böggild of Copenhagen proposes to apply to the whole potato in order to bring it into a soluble state, to make it more easy of digestion, and thus to increase its feeding properties.

He washes his potatoes well, steams them thoroughly, and then, *without allowing them to cool*, he cuts them in a cylinder furnished internally with revolving knives, or crushes them in a mill, and mixes them with a small quantity of water and three pounds of ground malt to every 100 lbs. of the raw potatoes. This mixture is kept in motion and at a temperature of 140° to 180° F., for from one to five hours, when the thick gruel has acquired a sweet taste and is ready for use. Given in this state, the results of experimental trials are said to be—

1*st*, That it is a richer and better food for milk cows than twice the quantity of potatoes in the raw state.

2*d*, That it is excellent for fattening cattle and sheep, and for winter food; that it goes much farther than potatoes when merely steamed; and that it may be economically mixed up with chopped hay and straw.

I have before me a pamphlet, published at Christiania by the *Royal Society for Promoting the Improvement of Norway*,* in which this method is strongly recommended; also a letter from Copenhagen, dated 29th April 1845, in which my correspondent writes as follows:—"This invention has been more and more appre-

* *Anviisning tilat benytte Potatos till Fodring paa den fordeelagtigste maade*. sammendraget af Tidskrifter og ud givet efter Foranstaltning af Det KONGELIGE SELSKAP FOR NORGES VEL.

ciated and applied in my native country (Norway) and in Denmark, and the great advantages with which stall feeding may be introduced, at considerably less expense than formerly, render it suited to general promulgation."—" The method has more and more gained adherents, and further comparative experiments, made by scientific and experienced persons, have proved its superiority. Thus one of these experiments establishes that an increase of 1½ lbs. of flesh is obtained from 25 lbs. of potatoes—that the feeding of horses with this mash is found to be applicable and cheap, and they all confirm that potatoes used in this manner as food amply afford double the nutritive powers compared to the food formerly used."

I cannot here state my reasons for believing that there is really something worthy of attention in the alleged superior feeding qualities of the potato given in this state, but I can strongly recommend you to make experiments upon the subject. If the potato can in this way be converted into a larger quantity of beef, mutton, or pork, than hitherto, another outlet will be provided for the potato crop which may perhaps prove more profitable even than the manufacture of it into flour.

Had I not already greatly exceeded the limits even of a printed letter, I should have told you of the fine stock I saw at Baldoon—of the pertinacity with which barley refuses to grow on some of the soils in "*The Machars*," while it grows well on others very near them, and apparently similar—and of the delight which most of the farmers of the district appear to have in seeing their liquid manure descend to the sea, and in supplying its place with guano. But I must conclude by subscribing myself yours very truly,

James F. W. Johnston.

A SKETCH OF BELGIAN HUSBANDRY.

Having set sail from London, in the beginning of April, in most charming weather, and with every prospect of its continuance, we arrived safe at Ostend after a most delightful passage. On nearing the coast of Belgium we could observe nothing but one continuous bank of sand, from Dunkirk to some distance past Ostend—rather a curious introduction to a fine agricultural country. But being now in Belgium, it will not be out of place here to inquire into the history of the soil about which we are going to speak.

[illegible] subject connected with Belgium about which so

much misapprehension prevails as its soil. We are accustomed to associate fine crops and superior farming with a fertile soil; and people generally, hearing of the great crops produced in Belgium, conclude, without farther inquiry, that it is blessed with a fine soil and a finer climate; and the yearly, but not exaggerated, accounts of the heavy crops, brought home by the railroad tourists, some of whom have compared the cutting down of a field of wheat to the slicing of a plum cake, tend, above all, to increase the mistake already abroad.

The general character of the soil in the western provinces of Belgium, where the most perfect system of agriculture is carried on, is lightness, which includes all stages of fertility, from the arid sand to the sandy loam. And though we find now much that really appears excellent soil, such, for instance, as that in the neighbourhood of Courtray, we have sufficient reason for supposing that it is not naturally a rich soil, but has been brought to its present state of fertility by the most laborious cultivation; and there is not the least doubt that, if the farmers were withdrawing their present careful attention from the soil, and the artificial treatment to which it is at present subjected were in the least relaxed, the broom and fir would soon assert their ancient dominion. The following extract fully bears me out in what I have just stated:—

What land is cultivated in Brabant is owing to the religious houses founded in it. Their uninterrupted duration for five or six hundred years, and their indefatigable industry, have conquered the barren harsh sands, and rendered many parts of them highly productive.

From the undoubted testimony of the historians of the low countries, it appears that the cultivation of the greater part of these rich provinces had its rise from the self-same means, eight hundred or a thousand years ago, when they were, in a manner, one continued forest.

The farmers of Flanders, therefore, are presented to us in a double character—*tillers* of the soil, and, in some places, at the present day, *makers* of a soil. Those who are anxious to study them in their second character are referred to Mr Radcliff's work on Flemish husbandry. I do not refer to the Polders at present, where the stiffest clays exist, and a totally different system is pursued. The only true clay I met with was in the neighbourhood of Ostend, where it was very stiff, and of a grey colour. On the road from Ostend to Bruges the soil is of various qualities. It loses in a great measure its stiff character as we approach Bruges, in the immediate vicinity of which it is in a high state of cultivation. From Bruges to Ghent the soil is very poor, and around the latter place it is little better than sand, and yet the crops we passed on the road were most luxuriant. The general aspect of the country from Ostend to

Ghent is that of a flat open country, not at all beautified by wood, and interesting to none but a farmer. There are no hedges, the fields being separated merely by ditches, on the banks of which are planted trees, which are cut at different intervals of time, from every fourth to every ninth year, according to the nature of the kind. They are planted merely to supply the people with firewood in those districts where other fuel is scarce. All kinds of trees are grown for this purpose. Between Ghent and Courtrai the scenery assumes more of an English character. The country is more wooded, which divests the landscape of that vapid tameness so peculiar to Belgium. Nor is the cultivation neglected. The luxuriant crops of rye, the healthy and equally dispersed brairds of wheat, and the neatness with which all the fields were finished, gave ample proofs of the skill as well as the industry of the farmers. The country about Courtrai has scenery peculiar to itself at this season, from the great quantities of rape cultivated here, and is also exceedingly beautiful compared with the usual Belgian landscapes. The vistas of trees have not yet expanded their leaves, while all around, the diffuse foliage of spring, insufficient yet to conceal the distant horizon, gives to the scenery an airy picturesqueness, and divests the country of that vapidness natural to it. Here, among the unfolded leaves, some stately poplars wave their plumes—there a village steeple overlooks the humble dwellings of its inhabitants—here some straggling villa, buried in a plantation, rejoices in its seclusion—and the landscape is improved by the innumerable and thickly-set farm places, each surrounded by a few scattered trees, while on the surface rest the farmer's hopes. Grains in every stage of their growth, and of every tint of green, flutter in the breeze, and the solid masses of ripe blossom roll in the wind, and form a beautiful contrast, from their saffron yellow, with the surrounding crops. But there is still something awanting to animate this otherwise beautiful prospect. No herds enliven the landscape—no flocks send forth their bleating—and the milk maid's happy voice is mute. Profit, not beauty, is studied in Flanders.

From Ghent to Antwerp we pass through a part of the celebrated Pays de Waes, the most thickly populated district in the world. Where the soil is little better than sand, the most laborious culture is practised, and the greatest comparative average crops are raised of any district in the world. In many places the soil presents a mottled appearance, from the imperfect amalgamation of the sand with the decayed vegetable matter. In no part of Belgium did I see such attention paid to the tillage of each field; the consequence of which is, that the crops pro-

duced on the barren sand are not far inferior to what you will find on ordinary soil. From the thickness of the population in this locality, they are enabled to turn over mostly all the soil with the spade, which would render the tillage, one would suppose, very tedious; but the tediousness is not felt, from the smallness of the farms and the excessive looseness of the soil. A man, with no pressure but that from his hands, sinks the spade more than a foot into the ground. Here, truly, it ought to be called gardening rather than farming, from the great neatness and excessive care bestowed on each field. From the sandy nature of the soil, they are enabled to finish off each field with all the beauty of a flower-bed, while a border of well shorn grass, about ten feet in width, surrounds the field, the edge of which is most carefully pared, so that, on entering one of these fields, we are apt to suppose that we are trespassing on the carefully swept lawn of some noble residence.

It is the Flemish farmers' boast that the system of agriculture they practise has been handed down unchanged to them from their forefathers; and this is the more to be wondered at, when we consider that in no country have so many and such sanguinary battles and wars been fought and carried on as in Belgium. From the trials of strength that have taken place in it between the first powers of Europe, it has justly been denominated the cockpit of Europe; and yet the scene of these dreadful struggles, the tendency of which is to retard all improvement, and to throw back to a state of pristine civilization all the arts of peace, of which agriculture is among the first, is also the seat of an organized and exemplary system of husbandry. Even when the last convulsion rent the kingdom of the Netherlands, and Belgium was subjected to all the anarchical disorder attendant upon a change in the form of government, and was deprived of the principal market for the products of its soil, its agriculture remained unchanged, and continues at present as if no such disturbance had happened.

Without attempting at present to account for this anomaly in the history of the arts of peace in a nation, we shall proceed to inquire into some of the excellences of that system which has been preserved amid the havocs of foreign and civil wars.

The farms in Flanders are small, the average size being not more than fifty imperial acres. Some are held on lease, others are not. The terms vary from three to fifteen years, some multiple of three as far as fifteen being the duration of a lease. In some the tenants have it in their power to quit at the end of every third year, while the landlord cannot put him away till his lease is out. It is impossible to say what the average rent of

the farms is; but, so far as I could ascertain, it may be stated at 30s. the imperial acre, for the best soils, exclusive of burdens, which are generally one-fifth of the rent.

The farmers of Belgium are a hard-working class of men—in the habit of labouring their farms, and generally ignorant of every other subject but their profession. But in it truly they shew rare sagacity and experience; and though unaided by, and almost despising, the light of science, they discover in some parts of their system of agriculture a perfection to which science has never yet guided the farmers of this or any other country. When we look back to the ancient grandeur of Belgium, when its cities were the marts and factories of Europe, and consider the consequent increase of population in a country naturally unproductive, we will discover a sufficient stimulus to excite the energies of a people gifted by nature with an indomitable perseverance and unwearied industry. This disposition, as well as its effects—their agriculture—has been handed down to the present generation of farmers, and still manifests itself in many operations which the negligent farmer would consider unprofitable, or, at least, superfluous; and it is from this praiseworthy industry that Belgium, comparatively a poor country, is considered by strangers as unrivalled in the salubrity of its climate and the fertility of its soil, and that the great part of the kingdom is prevented from returning to its original barrenness.

The number of servants who live on the farm throughout the year may be stated at six to the fifty acres, and these are paid as follows:—The men who perform the work of ploughmen and labourers receive 10s. a-month, with their meat, which the farmers value at 6d. or 7d. a-day, thus making the full wages of a man equal to 25s. a-month, or L.15 a-year. Their food consists of boiled milk and bread for breakfast, soup or butter-milk and bread and butter for dinner, with potatoes and pork five times a-week, and bread and milk for supper. The soup used is composed, according to Mr Radcliff, of butter-milk, boiled and thickened with flour or rye bread, potatoes, salt pork, salt fish, various vegetables, and eggs. They work from daylight till it is nearly dark at this season of the year, which, after deducting the hours of rest, will be about ten hours a-day. In summer it is longer. The women, who are hired to live on the farm, receive about 4s. 6d. of wages less in the year than the men. It may be observed that almost all the farmers take the same food as their servants. The day-labourers, who are only employed at certain seasons, such as for weeding the crops and engaging in the operations peculiar to flax-culture, receive 7d. and 8d. a-day, with their meat; and boys and girls have 5d. with their meat.

An ordinary working man will live very comfortably in a town in the south of Belgium paying L.15 for victuals and L.2 for the rent of one room for the whole year.

The farm-buildings are generally built in the form of a square, and consist of dwelling-house, byre, barn, stable, servants' sleeping-room, and cart-shed. The middle of the area included in the square is several feet below the level of the houses, and is admirably adapted for saving manure. The greatest cleanness prevails in every department of the steading.

The strength of horses kept on a farm is at the rate of a pair of horses to the fifty acres. And the number of animals supported altogether on the farm far exceeds anything we are accustomed to in this country. This, indeed, is one of the secrets of their farming; and we have no hesitation in saying that, in this particular, they excel the farming of any country with which we are acquainted. The keep of a horse is estimated at twenty-pence a-day. It is generally fed during the winter on oats, straw, beans, and hay; and in summer on cut grass. The horses are small, but compact, handsome, with beautiful action, and high-spirited. As no attention has been paid to the improving of their breed of cows, they are not distinguished for any excellences. They answer the purpose of the dairy, for which they are principally kept: they are generally black and white in the colour. After being for some years in the dairy, they are fattened or sold lean to the butcher, who is generally feeder as well as butcher. The most of the beef used in Belgium is that of these old cows. They have a practice by which they ensure the regular feeding of the calves, which they consider essential to quick fattening. Immediately after they have got their usual quantity of milk, baskets are put on their mouths, to prevent their eating anything in the interval between the feeding times. Few sheep are kept, and these are of the worst description.

The fields are small, and are divided merely by ditches. There is no such thing as a hedge or dyke inclosing a field. These, from the peculiar management of the stock on their farms, are quite unnecessary. But where thorns are used as fences, as around nurseries and gardens, the settings are put very closely together; and, after they have sprouted up a certain length, sticks are run along horizontally, and the young shoots are tied to these, so that in a short time, from the intertwining of the shoots, now grown into branches, the fence becomes quite impenetrable. Under-drainage is never practised. Much of the soil does not require it; but to facilitate the drying of the fields, and to draw off the surface-water from the plants, a spading of earth

is taken out from every furrow and scattered over the ridge, so that, in a heavy shower, the rain-water finds a ready course to the ditches which skirt the fields.

One of the points in which the Flemings shew their skill of management is the attention they pay to the working of the soil. Unless the soil has been thoroughly pulverized by repeated ploughings and harrowings, they forbear from sowing any crop. To this, in particular, among other causes, we must attribute the practice prevalent there of using small quantities of seed, and the beautiful, healthy, and equal brairds which cover the surface in spring. In many places they are not content with the mere use of the plough for this purpose, but resort to the spade also, either in giving an additional depth to the furrow, or in turning the whole soil over with this implement. In the province of Antwerp, we mentioned before that the spade was far more used than the plough for agricultural purposes.

An operation seen daily at present is the picking of the weeds from the young crops. Often the land is raked well before the workers commence their operations, for the purpose, as the farmers allege, of separating the plants, that the weeds may be more easily distinguished. But there is evidently another and more beneficial effect the raking will have upon the crops. It will loosen any crust that may have been formed on the surface, and thus admit of a more ready access of the air to the roots of the plants and the quantities of manure which are covered by the soil, thus aiding their action by a supply of oxygen. Some may object to the raking, from its exposing the plants to the action of drought, but the good derived from it, for the reasons stated, is more than sufficient to counterbalance any risk from drought. After the raking, the workers go over the whole field on their knees, picking out every useless plant. This is perhaps repeated several times in the season, according to the state which the field is in. Flax costs far more labour in weeding than any other crop; and the Flemings spend double time on it from the importance of the crop. A Scotchman, ignorant of agriculture, in passing through Belgium at this season, and seeing an extended row of women creeping on their knees among the young crops, and looking with the greatest care for injurious weeds, would be apt to extol the industry of the people, while he would accuse his own countrymen of indolence and carelessness in the minute, but no less important, points of husbandry. But he would be doing his own countrymen an injustice, in as far as he would condemn them for their non-performance of what they do in a more economical and as effectual a manner as is to be met with in Belgium. We allude to the practice of drilling grain-crops,

by which means the weeding of the crop is far more expeditiously accomplished than it is by the plan resorted to in Flanders. This careful attention to the weeding of the grain-crops is the more necessary in Belgium, where they are all sown broadcast; the soil is of that class which encourages the growth of annuals, and summer fallow or green drilled crops form rarely a part of their rotations.

The implements used in Flanders are so simple and rude that they scarcely deserve mention. There are two kinds of ploughs employed, one which is held by one hand only, and is of the rudest construction; and the other, called the Walloon plough, in which the body is attached, by means of its beam, to a framework on wheels, which connects it with the horses, and regulates the different depths to be ploughed. In this the mould-board is movable, and is changed at the end of every furrow from one side to the other.

The next subject of which we shall speak is the manures of Flanders; and some conception of the importance of this subject may be formed, when we mention that it regulates, not only the whole, but every individual part of the management of a Flemish farm. The first object and great aim of a Flemish farmer is to make or get manure; and, to carry this into effect, nothing that can contribute in the least to increasing a dunghill is thrown away. He cultivates food for cattle, and ties them up all the year round, that he may not lose any of the manure. He sows rape, and allows it to blossom and ripen, that he may obtain the seed for manure. His ashes-cart and urine barrels traverse every street in a town, every bye-way in the country, to collect this important necessary for his farm. It is in their management here that the farmers of Belgium excel those of every other country, and are thus enabled to extract more from the land than any other body of farmers. They act up, in short, to the true old adage that "Muck is the mither o' the meal kist." The principal manures used are farm-yard dung, urine, or liquid manure, rape-cake, and ashes. Minerals are seldom, if ever, used, and bones are almost unknown. I alluded before to the comparatively great number of animals kept by the Flemish farmers on their few acres. This they do principally for making manure to enable them to carry out their system of farming. On a farm of 63 acres, 3 horses and 15 milch cows, and several heifers for supplying the stock, were kept throughout the year, besides 6 cows and a few calves were fattened yearly. In another, of 77 acres' extent, 4 horses and 20 cows, with a requisite number of heifers, were kept, besides from 20 to 30 calves were fattened off yearly; and in a third, of 88 acres, 5 horses and 20 cows, besides

heifers and calves were kept. These farms were all arable, and were situated in one of the finest districts in Belgium. Mostly every crop receives some of this farm-yard dung, which is always well rotted before being applied. One of the peculiarities of the Flemish system is, the extensive and various uses they make of the urine from the animals kept on their farms. Every one has heard of the urine tanks of Flanders, which are to be found all over the country, at home, and in the fields. They are built in a most substantial manner, and so far under ground, that when they are covered in, the farmer is enabled to cultivate the soil over them. Contracts are generally entered into between the farmers and those in towns who have much of this at command, such as brewers, distillers, &c., who fatten animals from the refuse of their works. £2 is commonly given for the urine of one animal for a year. The farmer, at stated periods, conveys, by means of barrel-carts, what is collected in towns to his subterraneous receptacles at the corners of his fields, to be ready for the seed-time. The crop to which it is principally applied is flax; and then they dissolve in it rape-cake, which renders it a most powerful manure. After the flax-seed has been sown and covered in, and rolled, so that the surface is made quite smooth, they proceed to apply this mixture. It is applied in the following manner:—Five men are employed altogether, two to pump, two to scatter it, and one to drive it. A rectangular piece of ground, thirty yards in breadth, is measured off across the ridge; this is sub-divided into six portions of five yards each. The field was laid off in ridges of ten yards. Six wooden vessels are filled and placed in the middle of a ridge at the distance of five yards from one another, so that the contents of each vessel, which is about the size of a potato firlot, is the allowance for every fifty square yards. There is nothing in which they manifest such economy as in the saving of this material, which they prize as a most valuable assistant to their labours. Rape-cake, besides being applied as mentioned above, with the liquid manure, is also used in a dry state. The rape is cultivated principally as a manure, and is used extensively where the cropping is very severe. Ashes are never used but as a top-dressing to clover; but the traffic which is carried on in them, between Holland and Belgium, is sufficient to form a distinct trade with a certain class of merchants in Belgium. The farmers in Belguim set a high value on them, and place so much dependance on them for the success of their clover-crop, that (I understand, from what I have read) there is a current saying among them, that "He who buys ashes for his clover-crop, pays nothing; but he that does it not, pays double." It is really surprising that this manure, which has been proved to be so efficacious by a class

of experienced farmers like the Flemish, has never yet been tried, or at least sufficiently tested, in Scotland. I believe some were imported in the beginning of this year by Messrs John Mitchell & Co., in Leith; but I am not aware that they have met with the reception we would anticipate from the well-known successful results of their application in Belgium. There is nothing so much wanted at present, in the agriculture of Scotland, as a good lasting top-dressing for clover. The failures in this crop have been frequent of late, and the effects of nitrate of soda last only with the crop to which it is applied, while sad disappointments have been experienced in the use of gypsum. But before recommending an extensive use of this material, I would suggest a few comparative trials to be made with it, gypsum, soot, and other substances; for if the failure of gypsum arose from there being a supply of it already in the soil sufficient for the growth of the plant, an application of Dutch ashes might be attended with a similar result, as the great proportion of the ingredients of the ashes are salts of lime, with the useful addition, however, of some salts of soda. Some attribute their great effects in Belgium to the lime which they contain, as few of the soils there have any amount of lime in their composition. They are applied in different quantities to the soil, from ten to thirty bushels an imperial acre.

The crops raised in Belgium are wheat, oats, rye, flax, potatoes, rape, and clover, as principal; and, as secondary, turnips, carrots, buck-wheat, tobacco, and spurry. The farmers consider flax and rape the best paying crops they cultivate, and they are the most exhausting; hence the enormous quantities of manure given them. The rape is sown in July, transplanted in September, and cut in June of the next year. The clover, which is grown for seed as well as for food for cattle, is an important crop with the Flemish farmer. He is not particular among what he sows it. We find it growing amongst flax, wheat, oats, or rye. There are two varieties of rye used, winter and spring. The winter variety is almost always sown after potatoes in December, and some of it is cut green in spring, before the clover is ready for cutting. It thus answers the purpose of early tares in this country. Another crop is taken the same year, after it is cut. The ground is ploughed several times for potatoes. When the last ploughing is finished, the furrows of which are about seven inches wide, one man walks up one of the furrows, and, with an instrument similar to that used for picking turnips, makes a hole, into which a boy drops the cutting of a potato. Eight inches farther on, another potato-set is put, in making the hole for which he draws the soil over the previous setting. This he does every second furrow, so that the distance between each row of potatoes is not more than fourteen inches. One man and a boy do about 450 yards in this manner in an hour. The turnips are almost always taken as a

second crop in the year. Immediately after the rye is cut, they begin to prepare the land for turnips; and, by the powerful agency of the liquid manure, a beautiful braird is obtained in a few days. The turnips have attained a pretty good size when they are pulled, and, with the potatoes, form the winter food for the animals on the farm. Carrots are often sown with flax, so that they are enabled to have two crops the same year from the land; for by the time the flax is pulled, the carrots are considerably advanced. This method of double cropping is very frequent in Flanders, and is another instance of what, by economy of manure and a judicious application of it, they are enabled to produce from the soil.

The next subject which comes naturally after this is the rotations of crops practised in Flanders. I was prepared, before crossing the channel, to encounter some little difficulty in this subject, from having read of the great variety of rotations to be found there. Every field, Mr Radcliff tells us, has its own rotation. But the four, five, or six years' courses to which we are accustomed in this country, made me form but a faint idea of the difficulties of comprehending the Flemish courses; and, therefore, when I began to study them, these exceeded my greatest anticipations, and every day I renewed my inquiries but plunged me into greater perplexities. I could perceive no fixed principle on which they founded their constantly varying rotations. The same farmer would give me one day one rotation, and the next another totally different from yesterday's, as the rotation he practised on his farm; and, were I to transcribe all the various systems I jotted down in my note-book, as those followed on farms within the narrow compass of a few miles, I would fill as many pages as this short sketch of Belgian farming would require. With such conflicting statements, and with no prospect of unravelling the mystery, I began to solace myself with the thought that the Flemings had no such thing as a rotation, that they knew the value of a change of crops each year, and therefore they practised a succession rather than a rotation of crops. If they are rotations, it is difficult to tell where they commence and where they end; and they are besides extremely long. The principle they seem to go upon is, that the same crop shall not be taken two successive years from the same land. And on examining my heterogeneous mass of rotations, I have been enabled to trace out the few following facts:—That wheat and rye almost always succeed potatoes, and rye, potato wheat; the place of flax seems to be after oats and before wheat or rye. Clover is sown with any of the principal crops. Rape seems to succeed oats or rye. I think I cannot do better than conclude this part of the subject in the words of Mr Radcliff—

In Flanders they would consider their industry and their manure inefficacious [illegible] rotation; hence the variety of suc-

cessions which we observe at every variation of the soil. They have been farmers time out of mind, rotation farmers for centuries; there is not a cultivated acre, the properties of which are not matter of notoriety, and, according to those properties, the most suitable succession, and the most profitable application of manure, have been long since resolved on, and are now invariably practised.

It may not be out of place here to introduce the management of a farm in the high country or Walloon district. The farms there are much larger than in the low country: 150 acres are there considered a small farm, and many of them are 1000 acres in extent. The size of the farm about which I obtained most information was 200 acres. The whole of it was under the plough but twelve acres of meadow. There were only three ploughs used; but twelve horses were kept and used for farm work alone. The cause of this great number of horses is, that they never put fewer than four horses, and often six, into their waggons. They have, besides, twelve young horses of different ages, and fifteen cows, which is the whole of the stock kept on the farm. The rotation is generally potatoes, wheat, rye, oats, with clover sown with one or other of them. When we speak of this being the rotation, we do not mean that it is followed with unaltered regularity; for the most profitable crop here is wheat, which the farmer endeavours to grow on a third of his farm. They are near lime here, of which they avail themselves, by applying considerable quantities to the soil. I saw some applied as a top-dressing to young clover. Ashes are also used for the same purpose; but they are much redder in the colour than those I saw in the low country. The coal burnt here is always mixed with clay, to bind the pieces together, as it is all in small pieces, the largest not being larger than a hen's egg. This may cause the red colour in the ashes referred to. They are not so careful of their manure as in Flanders, nor does the same attention seem to be paid to the land. Wages are much the same as those mentioned before.

This is a rough outline of Belgian farming, from personal observations there. I must admit that there is much that might be very profitably introduced and mingled with Scottish husbandry. A little more latitude and variety in our rotations would, while it would increase our productions, benefit the soil. But such a change would have to be introduced with caution, as otherwise it would shake the whole fabric of our agriculture, which rests so firmly on its present foundations; and while we would cull out the excellences of Flemish farming, and ingraft them on our own system, we would not commend it as a whole. And he who would attempt to introduce it into this country, either as a whole or in certain of its parts, would not only expose himself to ruin, but prove himself ignorant of the different states of the two countries, and of the first rudiments of good farming.

P. M'L.

THE FARMERS' NOTE-BOOK.—NO. IX.

Manure. By J. Towers, Member of the Royal Agricultural Society of England.—The subject of manure is one of the most important. I have taken a deep interest in it; have observed for myself, and read attentively the opinions that have been broached from time to time; and have plainly perceived that in this, as in every inquiry which of necessity has a theoretic base, men are but too apt to jump at hasty conclusions, and to assume as probable facts those opinions which result from merely a few casual inadequate experiments.

It is unquestionably true that, since the appearance of "Liebig's Organic Chemistry" in 1840, the theory of vegetable nutrition has undergone a complete revolution; but whether or not we have approached to a sound undelusive hypothesis, is somewhat questionable. It, therefore, shall be the object of this article to retrace the course of our advances.

Few, very few years have elapsed since our best agricultural writers took but one view of the agency of manures. This will become the more evident by referring to the well-written article "On Manure," of the Penny Cyclopædia, which appears in vol. xiv., published in 1839, and, therefore, of recent date. The following paragraphs will elucidate the theory of manure as it was received only *one year* prior to the publication of Liebig's work:—

> The substances which have generally been used as manures are numerous and various, and have been divided into *stimulating* and *nourishing* manures. All saline substances are ranked under the first, and all organic matter under the second. From the most accurate analysis of the component parts of plants, it is ascertained that salts and earths form a very inconsiderable portion of their substance, and that carbon and water furnish by far the greatest part. The nitrogen of the atmosphere is found only in some of them, and all metallic substances seem entirely adventitious.

These preliminary statements lead to the consideration of the two theories which have occupied the attention of agricultural writers during the last seven years.

The first, and that upon which the arguments of the article in question are founded, is the *theory of humus;* and this comprises all those facts which are, and have been from the most remote period of antiquity, adduced to shew that manure must be rendered soluble *within the soil*, and be thence taken up by the roots of plants, to be converted by the organs of the leaves and cellular tissue into nutritive food.

The second or atmospheric theory of Liebig is based upon the assumption that the woody or carbonaceous matter of the entire plant is obtained from the air chiefly by the leaves, the earth furnishing the inorganic constituents of the organized only. The *humic theory*, as opposed to the *atmospheric*, asserts that plants will not thrive unless there be in the soil those substances

which contain carbon; in other words, animal and vegetable substances: that from whatever source the oxygen and hydrogen of vegetable substances are derived, the *carbon* comes from the decomposition of organic substances, either animal or vegetable, and that these, in a certain state of decomposition, afford the supply of carbon by which the plant increases and secretes its juices. Finally, that the opinion entertained by some, that all the carbon of plants might be derived from the atmosphere, is not supported by any proof whatsoever.

In attempting to reconcile these jarring hypotheses, both of which are compatible, *de facto*, with philosophic truth, I must assert that crops cannot be produced in due succession, and brought to that high degree of prolificity which an increasing population imperiously demands, without the introduction, *into the heart of the soil*, of an abundant quantity of decomposable substances, of animal and vegetable remains, that is, of *hydro-carbonaceous bases*, with certain portions of nitrogen. So far, all practical men are agreed: so far, every candid man of science is prepared to acknowledge. It is not then a question of doubt as to the bold fact; the difference of opinion will be found in the mode of operation by which carbonaceous manures are supposed to effect the nutrition of plants.

Liebig is misrepresented whenever he is said to refer all nutritive offices to the leaves; for he asserted, from the first, that "the fertility of a soil cannot remain unimpaired, unless we replace in it *all those* substances of which it has been deprived. Now this is effected by *manure*."

If we look back a few years, before it even entered the imagination that agriculture could be considered a branch of chemical science, we shall find that manuring was a practice of mere empirical routine. Sir John Sinclair, in that estimable work, the "System of Husbandry," thus generalizes:—

On the whole, dung being the most essential ingredient for promoting fertility, the utmost exertion ought to be given by every farmer to collect it in as great quantities as possible, and to prepare it for use. Calcareous and other manures, in particular cases, are also necessary, especially for reclaiming land in high situations or stiff soils; but animal and vegetable substances, when reduced to a putrid state, are peculiarly well calculated for recruiting exhausted land; and if *a sufficient quantity for that purpose could be procured, the arable land in this island might be made to produce triple the quantity it now does*. How loudly does not this call for attention, not only to promote its increase, but to prevent its abuse and improve its quality?

Here we have a few rational inferences derived from simple observations of results: but no allusion to chemical agencies; no appeal to causes. In fact, Sir John Sinclair's work is a collection of evidences upon the authority of practical men of the first eminence in Scotland; and if it shew, as indeed it does, that scarcely two farmers agreed upon the same point, yet it irrefragably proves that the skill, industry, and candour of our northern brethren, did then, thirty years ago, as they do now, put to

shame the inferiority of our cultivators of the south, who, with infinitely greater natural appliances, appear contented to go on complaining of losses, badness of times, inadequate remuneration, and want of protection!

About the period of Sir John Sinclair's first edition, the late Sir Humphry Davy published his "Elements of Agricultural Chemistry," comprised in a series of lectures delivered every session before the then Board of Agriculture, from 1802 to 1812. In the fourth lecture this profound chemist treated "of soils, their analyses, uses, sub-strata, and improvement." He, perhaps, was the first British author who entered practically into the chemical investigation and arrangement of earthy constituents. His method of analysis was simple, and in advance of the agricultural science of the day; but it was far below that which now is adopted, and is utterly insufficient to detect those minutiæ that modern science has brought to light.

In the sixth lecture Davy investigates manures of vegetable and animal origin, and in his attempt to ascertain the way in which manures act, he pointed out the great and important fact, that the pores in the fibrous roots of plants are so small, that it is with difficulty they can be discovered by the microscope, and, therefore, that it was not probable that any solid substance could pass into them from the soil.

> I tried (he says) some impalpable powdered charcoal, procured by washing gunpowder and dissipating the sulphur by heat. This was placed in a phial containing pure water, in which a plant of peppermint was growing. The roots of the plant were pretty generally in contact with the charcoal. The experiment was made in the beginning of May 1805. The growth of the plant was very vigorous during a fortnight, when it was taken out of the phial. The roots were cut through in different parts, but no carbonaceous matter could be discovered in them, nor were the smallest fibrils blackened by charcoal, though this must have been the case had the charcoal been absorbed in a solid form.

I have repeatedly stated that, so far from any solid matter being absorbable, it may be more than doubted whether even colouring matter can enter a rootlet or spongiole of a plant growing in its natural condition. I tried three balsams, with semi-transparent white stems, for three weeks, watering the *simple loam* contained in small pots, one with solutions of logwood and another with a salt of iron, yet neither by dissection nor by delicate tests could I obtain a trace of either; nor did it appear that any fluid but water had passed through the roots. At the same time, I had proof, palpable and demonstrative, that any colouring matter, even common ink, could ascend to the extremity of a plant, or woody twig, were it inserted, as *a cutting*—that is, a mutilation—into the liquid.

It may then be assumed as a fact, that not a particle of matter, as a solid, is ever taken up by the roots from the soil, and, therefore, that the idea of the plants *feeding upon th manure* by absorption of substance is a palpable absurdity.

The advocates of humus, though prepared to allow that the solid substance itself could not pass into the roots, contended that, by the application of lime or alkali, it, or that portion of it styled *humic acid*, might be dissolved and rendered fluid. This admission might almost suffice to upturn the theory that *humus* was, in itself, the prepared and "cooked food" of plants; yet even so far it failed in its object; for, to say nothing of the extremely small quantity of soluble matter, the dark fluid so produced was too gross, and required filtration ere the pores could let it enter the tissue.

It is not, however, a mere question of the existence of solid *humus;* for those very parties who claimed it as a *sine qua non* had no hesitation to affirm that the urinous liquid manures of the stall were even more efficient than the more solid matters when reduced to the condition of humus. The treatise first alluded to thus expresses itself.

In all countries where stall-feeding is practised, the lands are highly manured, and the crops more certain and abundant. With this system is connected a much more economical management of the manure, by keeping the litter and more solid parts of the dung separate from the urine and liquid parts, which are collected in large reservoirs, and used in the liquid state, and applied immediately to the land, or in the formation of compost heaps.

This paragraph alludes to the celebrated Flemish husbandry, so ably explained by the late Rev. Mr Rham. But Sir John Sinclair was not indifferent to the practice. He observes, "Urine is advantageously employed, either by pumping it over the dunghill, or as a compost with peat, fine earth, or the refuse of the tan-pit." One of his authorities, Mr Charles Alexander, near Peebles, informed him that he had made a pit about twelve yards square and four feet deep, which was filled with fat earth carted from headlands or elsewhere, and levelled on the surface, so that the urine of the cattle, conveyed to the pit by a sewer, may spread equally over it.

I do not attempt, at this time, to inquire into the efficacy or comparative importance of liquid urinous manures, but hope to shew by evidence, that, if (according to the assertions of those who advocate the theory of humus) that substance ought to be considered the "prepared food of plants," his theory receives a heavy side-blow by their avowals respecting the still greater efficacy of liquid aliment.

Davy was perhaps the writer who originated the idea of humus, by describing that fine black substance which results from the slow decay of vegetable and animal remains. He spoke of it as he found it among the multitude of other substances which he classed as manures; but he adds the following detail of a process that still more severely jostles the foundation of the humic hypothesis. "In October 1808 I filled a large retort with some hot fermenting manure, consisting principally of the litter and dung of

cattle." He thus obtained, *first* elactic fluid, consisting of carbonic acid, hydro-carbonate, with some azote, and then a quantity of liquid having a saline taste and disagreeable smell, and it contained also some acetate and carbonate of ammonia.

Finding, he says, such products given off from fermenting litter, I introduced the beak of another retort filled with similar dung, very hot at the time, *into the soil, among the roots of some grass* in the border of a garden. In less than a week a very distinct effect was produced on the grass, upon the spot exposed to the influence of the matter disengaged in fermentation. It grew with much more luxuriance than the grass in any other part of the garden.

If the mere gaseous fluids conveyed through the beak of a retort, assisted by a few drops of ammonical fluid, confer vigour and comparative luxuriance, first to the roots and then to the herbage of some grass, what becomes of the theory which implies the paramount importance of solid aliment?

In glancing at the modern theory which dates with the publication of "Liebig's Organic Chemistry," I cannot but express regret that the same spirit of jumping at unwarranted conclusions has been adopted. Liebig asserted the indispensable necessity of renovating the soil by *manure:* he also made the most pointed allusions to the presence of *ammonia*, giving it for the first time (as an appliance to agriculture) a local habitation and a name; and he also dwelt forcibly upon the necessity of studying the nature and application of *inorganic* substances, that is to say, those constituents discoverable in vegetable structure, which, as they would not be produced by any combinations, definite or indefinite, of the four great natural elements, *oxygen* and *hydrogen*, (as water,) *nitrogen* and oxygen, (as atmospheric air,) and *carbon* and oxygen, (as carbonic acid floating in air,) must be traced to, and obtained solely from, the earth.

But our modern ultras refer all to the inorganic elements. They seize upon hundreds of tons of manure, analyze, tear, and rend it to pieces; reduce it to a few pounds of ashes—its inorganic residue; and then tell us that these are *all which a crop can* absorb *from the soil*, the carbon going for nothing, save and except so much as can be introduced to the structure by the pores of the foliage.

They who have perused the controversy lately carried on in several of the agricultural journals, between that able practical man, Mr Hewitt Davis of Croydon and Mr Nesbitt the analyst, will be prepared to comprehend the bearing of the two theories, the former adhering to, and making stout fight in the cause of, manure, the latter applying with all the force of assertion in behalf of ultra inorganism. We will now attempt to reconcile both hypotheses by clear induction from facts.

Taking it for granted that, till within a very recent period, the analysis of plants and of soils had been conducted upon very vague principles, and that. till Liebig insisted upon the value of trust-[illegible] investigation of the products of vegetable combustion, we

were very ignorant of the analogy which exists between the inorganic constituents and the saline and earthy matters of the soil, we must admit that the science of agriculture begins to acquire a new position, but that we shall never make advances so long as we adhere to old prejudices. *Manure*, that is, the refuse matters of the byre and farm, has been, time immemorial, committed to the ground, and results have followed which proved, beyond question, that its effects were to some extent beneficial. Of causes the farmer neither knew nor sought to know anything, content to go on in the jog-trot of his forefathers.

But when analyses began to discover the identity between products and certain chemical agents, it became rather apparent that more rigid inquiries ought to be instituted, and in this position we find ourselves at this precise moment. Before I say anything upon the appplication of manure, it seems right to allude to a new theory, which asserts that manure is not required at all; that crops can be produced without it; and it is further stated that the promulgator of the doctrine is now travelling from place to place on the Continent, for the express purpose of establishing the same. Of one fact I am assured—it is this: in the garden there are vegetables, particularly those of the cabbage family, which are purer, finer in growth and flavour, when grown upon good maiden loam, than when excited by the richest manure. In 1830, I came to the property I now occupy, in the second week of June. There was nothing in the garden; the whole was to be trenched in detail; the middle split of a plot, fourteen inches below the surface, was raised for a brocoli bed; the seed had to be sown, and the seedlings transplanted; and yet from this bed of unmanured hazel loam, I had finer and more perfect plants than any subsequent treatment has given me. This fact accords perfectly with common experience, and we must, therefore, refer for its elucidation to Liebig's saline hypothesis, and learn that the potassa, and other chemical inorganic matters, constituents of fresh loam, are the natural agents of such healthy luxuriance. This is all that I shall say concerning the absence of manure; yet we obtain a fact that is worthy of consideration, though by no means so comprehensive as to warrant the assumption of a theory which assails the first received principles of good husbandry. It is certain that a vast mass of ordure and otherwise useless matter exists, and would accumulate, not only on every farm, but over the surface of the whole land, were it not devoted to the purposes of cultivation. It is equally certain that such refuse, which, if left to accumulate, would become a pestilent nuisance, is convertible, when duly prepared and applied, into the nutriment of plants.

I was much gratified by perusing the heads of a lecture by Dr Murray, as given by a Scotch paper in the month of March.

After speaking of the application of science to the practice of agriculture—of the inadequacy of the present produce to supply a rapidly increasing population—and of the appliances by which, ere long, this country might not only be made independent of foreign growers, but even an exporter of corn, as it once was—the Doctor adds,

In regard to the supply of corn, I am disposed to adopt the opinion that, for any amount of population that may exist on the earth subsistence will always be found; and this would be the case at present in Britain, if we attended, as we ought to do, to the immense and incessant waste of the most valuable manure at home, instead of going to great expense to bring the very same from the distant isles of the ocean. We are greatly in fault in not attending carefully to the operations of nature. *The supply of food* and *the production of manure are commensurate with each other.* Were we, therefore, to collect the whole of the daily solid and liquid excretions of any man or animal, ferment, properly prepare, and apply them, I believe that they would grow, on any given well-prepared soil, as much food as would support that animal.

If we admit the efficacy of manure at all, we can scarcely fail to arrive at a similar conclusion; but to render the analogy a little more complete, let us go farther back, and consult the testimonials cited by Sir John Sinclair.

1. A Berwickshire farmer found that, on an average of three years, from two and a-half to three acres of straw, with sufficiency of turnips, would winter one ox; and in this way each acre of straw would produce about four double-cart loads of rotten dung of from thirty to thirty-five cubic feet each, which, at 5s. per load, would be 20s. per acre.

2. Mr Brown of Markle took the weight of straw produced on one acre of land well-managed, at one ton five and a-half cwt., and inferred that the quantity of manure made from an acre, especially if the dung arising from clover, turnips, and hay consumed on a farm is included, would be something more than *four tons;* consequently, that any farm of decent soil could be manured at the rate of twelve tons per acre, every third year, from its own produce, provided the corn crops were cut with accuracy, and the straw also manufactured into dung in a husbandman-like manner.

3. Mr Hope of Fenton estimated thirty to thirty-five stones of straw, each of twenty-two pounds, used as litter or in the fold-yard, as sufficient to produce a ton of well rotted dung; consequently, that 130 stones, the average produce of an English acre of straw, would give four tons.

Upon such estimates Sir John Sinclair remarks:—

If these calculations be right, it would appear that, on a farm where 300 acres are sown yearly, 100 may be manured from its own produce, at the rate of twelve tons per English acre, without any extraneous manure on the four-course system. 1st, turnips; 2d, wheat or barley; 3d, clover; and 4th, wheat or oats. They are founded, however, upon the principle of converting nearly the whole [white straw into dung, by consuming turnips and clover upon the farm. If that straw be much used as food for cattle, the quantity of dung manufactured would fall considerably short of what is stated.

Take it for granted that, so far as experience teaches, manure,

and that of the best and specifically appropriate quality, must be incorporated with the soil, in order to maintain its vegetative power, we are not yet arrived at the inquiry *how* it acts, but simply assume the general position that, unless the land be so supplied, in due season and quantity, it cannot sustain protracted courses of rotation; and we have been, moreover, instructed, by the authority of most intelligent practical men, that each good well-managed farm, under ordinary circumstances, can produce manure once in three or four years adequately to the calls as yet made upon it, without having recourse to extraneous or artificial supplies.

But, then, it is not sufficient to convert, by means of the live stock kept upon a farm, all the straw it produces into available manure; *what we really require is, to know how to meet the demands of a population increasing at a ratio which almost defies calculation!* Let us seriously reflect upon the almost total neglect and waste of that great material of fertilization produced by the human race, and then put the question whether, by any possibility, the excretions of those animals which feed only upon herbage *can* supply the food consumed by a population already doubled in numbers, and which increases rapidly by millions.

If animal manure be the refuse matter of vegetable substances, changed by the processes of digestion and secretion, it ought by analogy to be applied to the growth of crops devoted only to the nutrition of the animals which excrete it. But when we consider the food and habits of man, it is essential that we take into the account that he is a very *general feeder*, that he consumes, and in vast quantities, not only the farinaceous substances produced from the land, but the flesh of beasts, of fowls, and of fishes. The secretions then which result from such a diversity of elements must combine all the substances, organic and inorganic, that are required to produce sustenance adapted to the human constitution. This is a condition which, it should appear, must be complied with, if we wish to realize and verify the fact inculcated by Dr Murray, that "the supply of food and the production of manure are *commensurate* with each other!"

In Flanders the utmost vigilance is exerted with respect to the collection and disposal of all the *cloacine*, (for by this term it is proper to express the human excretions;) and there, and by such means, a barren sandy desert has been converted into arable land of the most productive character.

In China, as Liebig has shewn, so much value is attached to the influence of this perfect manure, that the laws of the state forbid that any of it should be thrown away, and reservoirs are placed in every house, in which they are collected with the greatest care. No other kind of manure is used in China;

and be it remarked that the seeds of weeds, which pass undigested through animals, never occur in cloacine.

If we admit, (says Liebig,) that the liquid and solid excrements of man amount, on an average, to 1½ lbs. daily, (4 lb. liquid urinous, and ¼ lb. solid,) and that both taken together contain three per cent. of nitrogen, then in one year they will amount to 547 lbs., which contain 16·41 lbs. of nitrogen, a quantity sufficient to yield the nitrogen of 800 lbs. of wheat, rye, oats, or of 900 lbs. of barley, (*Boussingault*.) This is more than it is necessary to add to an acre of land in order to obtain, with the assistance of the nitrogen absorbed from the atmosphere, the richest possible crop every year.

Till Liebig wrote, we heard nothing or little to the purpose, of nitrogenous salts—*ammonia* was a word which found no place in the farmer's vocabulary; but now we are overwhelmed with the subject, and the fixation of ammonia has become, as it were, the burden of a song. On this I venture an opinion, founded upon received data, that, although it may be prudent, and even advisable, to convert the ammonia into a fixed sulphate by means of sulphuric acid, whereby the offensive odour of fermenting urinous liquids, whether of tanks or of common privies, would be subdued, yet I am far from believing that the ammonia developed from the decomposing urea in such receptacles is ultimately lost to vegetation. It is a great truth, that not a particle of matter ever was, or can be, really lost; and, therefore, if volatile ammonia escape, it can only pass into the atmosphere, and there become united with aqueous vapour. So united, it will descend with the rain; but if through electric action it be decomposed, and its elements (hydrogen and nitrogen) be developed, there will be still no loss. The great natural agents will convert those elements into some compounds, the minutiæ of which, though not understood by us, are such as must be available in the wise economy of nature.

I am aware that some persons doubt the presence of carbonate of ammonia in rain and snow water. I have detected it myself by the simple slow evaporation of the former, to which a small quantity of muriatic acid was previously added, to prevent the volatilization of the ammonia; but, then, I claim nothing in proof, because there might have existed coal-smoke in our atmosphere. But when one peruses the following refined experiment by Liebig, doubt ought to vanish:—

In the laboratory at Giessen, all the rain-water employed in this inquiry was collected 600 paces south-west of that place, whilst the wind was blowing in the direction of the town. When several hundred pounds of it were distilled in a copper still, and the first two or three pounds evaporated with the addition of a little muriatic acid, a very distinct crystallization of sal-ammoniac was obtained: the crystals had always a brown or yellow colour. Ammonia may likewise be detected in snow-water.

It is worthy of observation that the ammonia contained in rain and snow water possessed an offensive smell of perspiration and animal excrements—a fact which leaves no doubt respecting its origin.

If then the atmosphere and its watery vapours acquire their

ammonia from bodies putrefying and fermenting upon the earth, we may safely trust to those agents for there conveyance of ammonia to the earth in every falling shower. Upon these grounds the fixation of ammonia might appear a mere secondary consideration; yet, for the reasons before given, it will be prudent to add sulphuric acid to urine tanks, and especially as the fixed salts, when given to the ground, will be again decomposed, and yield up gaseous ammonia when they meet with lime. Speaking chemically, all the salts which have ammonia for their base are decomposed in the *cool-way*, whenever they come in contact with *quick-lime*, and by *chalk*, (carbonate of lime,) under the influence of high temperature carried to red-heat. In land, lime quickly becomes mild and effete; still, by the agency of electricity, mild-lime, or chalk, may act on ammonia salts. But, be this as it may, if such salts (which Dr Ure styles potential ammonia) are required by plants, and are present in soil, nature will effect the required appropriations either through their roots or within their tissue.

We hear of liquid manures, as, for instance, the drainage of cow-houses, and of the peculiarly good effects produced by watering the earth with them. Wherever I have tried such applications upon grass, discoloration and aridity were the results, and many persons whom I have consulted on the practice, had discontinued it for similar reasons. Yet these urinous fluids are the very quintescence of manures. They are rich in ammonia and potash salts; and the former, if fixed so as to prevent spontaneous decomposition, are too concentrated to be poured over green herbs. Most farmers, if they take any care of them at all, distribute their liquids over the dung-heaps, and thus again incur waste and loss, unless some receiving tanks, like those described and used by Mr Mechi, are at hand. But the wise economy of urine would be to spread it over a broad and deep bed of loam, peat, or turfy earth, protected from rains by a shed till the earth were saturated, when it would become the best top-dress imaginable for pastures—a fine and valuable "*urate*," wherein the fibres of grasses would revel. Sir John Sinclair, on the authority of Dr Coventry and others, pointed out the disadvantages of top-dressing with dung:—

There must be great waste whenever putrescent manure is spread on the surface instead of being covered by a portion of the soil. Animal and vegetable substances, if exposed to the atmosphere in a putrefying state, will almost entirely disappear.

This is quite true, and, therefore, all solid manures should be incorporated with the earth, never being suffered to lie upon its surface; and, generally speaking, the liquid which drains from the farm ought to be mixed with soil to be used as top-dress, in all cases wherein that mode of enrichment is required.

Chemically, it appears that the *solid* excrements contain the bile, all the insoluble phosphates and silicates, and the matter

of *humus* in its crude form; while the *liquids* consist of the soluble phosphates, the salt of soda and potassa, and the basal or potential salt of ammonia, dissolved in a very great volume of water.

Application of Liquid Manures to Forest-Trees. By Mr PETER MACKENZIE, West Plean, Stirling.—I have often thought that some gardeners, from the manner in which they treat their fruit-trees, would make excellent foresters, and foresters, on the other hand, should be made growers of fruit-trees. The gardener, in preparing his ground in the garden or orchard, for the reception of his fruit-trees, generally trenches his ground, and at great trouble procures earth from a distance, if he is not satisfied with that near at hand; he also dungs pretty well when he can obtain manure, and allows a good distance between the trees, and whatever his crop of fruit may be by such treatment, one thing is certain, he never fails in having a plentiful supply of wood. The forester, on the other hand, is less careful in preparing the soil for the reception of his young trees, and he plants much closer than the gardener, and the consequence is, his plantation soon becomes one of shrubs, bearing seed at an early age, as if the obtaining of seed were the object of the planter. Such precocious forest-trees are seldom of much value to their owners, when the object of planting them is to obtain timber. They set early in their growth, and their short shoots, with dead and dying points, are indications that their end is drawing to a close, and instead of the tall and handsome tree that was expected, it is cut down to make a stake to stop a gap in a quickset hedge. Such is the fate of thousands of our forest-trees. It is true, the forester has seldom soil and situation equal to that of the gardener, but what good reason can be given for planting thick in poor soil I have never made out. So many hungry mouths, increasing the more the poorer the soil is, soon devour the scanty supply, and the stunted plants, with light-green leaves, are sure marks that the famine has commenced. We are told that thick planting is good for shelter and nursing, but long may animals and vegetables be kept from the shelter and nursing afforded by trees in a state of suffocation and starvation!

Perhaps statements regarding the manuring of a few hard-wood trees may not be without interest to many readers of this Journal. The plantation was made about twenty-six years ago, in a soil of a sandy nature, about six or eight inches deep, the subsoil being stony and clayey, or what is commonly called a tilly subsoil. At present the trees are chiefly oak, elm, maple, Spanish chestnut, birch, and a few larches; but I will confine my remarks to the elm and maple or sycamore, and my object in doing [illegible] what may be done without much trouble,

in producing fine trees in shallow soils, by watering the roots occasionally with liquid manure. We are informed, by writers on forest-trees, that, in order to have large elm trees, they must be planted in good deep moist soil. The elm trees generally have failed that were planted in the soil already noticed; they became stunted in their growth and dead at the extremities of the young shoots, and when cut down were dark coloured in the centre of the wood. The few that remain measure, on an average, about 1 foot 7 inches in circumference at 3 feet from the ground. The maple or sycamore in the same soil, measure about 1 foot 9 inches in circumference at 3 feet from the ground. In the same plantation and same soil, there are two places where the maple and elm have grown much better than the rest. These have had their roots occasionally watered with liquid manure, and the difference in the measurement of their stems shews that they agree well with such treatment. In one of the places, the circumference of the maple, 3 feet from the ground, is 3 feet 5 inches, and contains about 12 cubic feet of timber, and the elm measures 4 feet in circumference, and contains about 20 cubic feet of timber; in the other place the maple measures 3 feet 6 inches in circumference, and contains about 14 cubic feet of timber; and in both places the trees are remarkably healthy, and stand about 18 feet apart from each other. At that distance asunder there may be about 135 trees grown upon the acre. At present the cubic foot of maple is sold at upwards of 4s. Now a tree of 14 cubic feet, at 4s. the foot, will bring £2 : 16s., and 135 trees at that rate will give £337, whereas the other trees at the same age, but which received no manure, will scarcely find a purchaser, not being large enough for the purpose to which maple is at present employed.

It may be a long time before much manure can be spared for growing forest-trees, and there are some kinds to which it would do more harm than good if it were applied, such as the pine and fir trees; but if even the slops thrown away as waste water from gentlemen and farmers' kitchens and dairies were applied to the purposes of arboriculture, there would be both pleasure and profit derived from the application. Many a maple tree may be seen growing in soils naturally poor, and unfitted to carry heavy timber without assistance, and trees considered by many to be in the last stage of existence, may be made to renew their growth; for, give a tree room to grow and food to live upon, and vegetable physiologists will not be able to tell how long it should live or how large it should grow.

Tallow and Train-Oil as a Salve for Sheep.—In the Highland and Agricultural Society's Transactions for 1844, pages 271–273, an article appeared, recommending the use of tallow

and train-oil, in equal parts, as a salve for sheep; and, in reference to that article, a gentleman in Argyleshire, skilled in the management of sheep, writes as follows, under date the 9th July last:—

The salve I used for my sheep last autumn, (viz. one half tallow to an equal proportion of train oil,) has, in every respect, answered the description given of it in the Society's Transactions; and one of my tenants whom, with some persuasion, I got to smear thirty of his flock with that mixture, admits that they are in better condition than any of the others—that the wool will weigh as heavy as that done with tar and butter—and that he will get the price of white wool for it. The expense last year was a little greater than tar and butter, as I paid 1s. 6d. a-pint for oil, and 6d. a-pound for tallow, but this year I shall get oil for 1s. a-pint, and if a quantity is required, at probably a lower price.

*Macgillivray's Domestic Cattle.**—It has often been a matter of surprise to us that works on the domestic animals in this country are not more numerous and useful than they really are. It might have been supposed that the great attention now paid to the breeding and rearing of almost every kind of stock would have created a desire for every kind of information that could be brought to bear upon the subject. An accurate acquaintance with the general history of the various races, both in regard to what may be more strictly called their natural history, and what may be designated their artificial history, or the modifications which have been produced by the influence of man, is the most likely means of improving the practical treatment, and enabling us to attain those objects which are thought most desirable in regard to these animals, and bringing them nearest to our ideal standard of perfection. It may be said to be but very lately that the services of the artist have been made available in illustrating this subject; although there can be no doubt that well executed pictorial representations are of great utility, not only in conveying an accurate notion of the general form and colour, but also in shewing the various points or particular developements on which breeders set so high a value. It is true that the art of the sculptor would be more effectual for this purpose than that of the painter. A correctly executed model or statue of a horse or cow would at once convey a perfect idea, both of its general form and of the separate parts; it could be examined on all sides, and the proportions measured; and even the most unaccustomed eye, by such means, would soon become familiar with all the modifications of form which are most highly prized. Not only might existing animals, as esteemed specimens of their kind,

* Portraits of Domestic Cattle of the Principal Breeds reared in Great Britain and Ireland; with Characteristic Descriptions of their Peculiarities and Comparative Merits. By William Macgillivray, A.M., LL.D., Professor of Natural History in Marischal College and University, Aberdeen. The portraits painted from the life, expressly for the work, by Mr J. Cassie, junior, and drawn on stone by Mr John Henderson. Parts I. to V. Blackwood & Sons, Edinburgh, 1845.

be thus represented, but we might have ideal models, exhibiting all the excellences which breeders aim at securing. No individual animal combines all the good points that are desiderated; these, however, might be united in an ideal figure; and just as the Apollo Belvidere and the Venus de Medici are the best representatives of their race, although not the fac-similes of any actual man or woman, so would our imaginary models be of their respective breeds. As each of these breeds has a distinct type of excellence, we would have a separate model for each, exhibiting all the merits they possess, as well as such others as are thought capable of being developed in them by skilful management. Up to this perfect exemplar of its kind the breeder's object would be to bring his stock, and he who succeeded in the greatest number of points would be regarded as the best breeder. In case of competition, the decision would not be, to such an extent as it now is, dependant on the will of the judges—an appeal would be made to the perfect representative—the eidolon, the τοκαλον of its tribe, and it would only remain to determine which competitor approached nearest this ideal paragon of animals. But where is the sculptor to be obtained that would satisfy our wishes on this point? It would imply a degree of attention to the delineation of animal forms, a care and a delicacy of workmanship, which few at present are capable of exerting, and the expense, moreover, would be such as few would like to incur. We must, therefore, be satisfied in the meantime with pictorial representations, however unsatisfactory in some respects these must necessarily be.

Three works illustrative of our domestic breeds of cattle have been published in Edinburgh within no great length of time. Their plan is similar, being to give coloured representations on a pretty large scale, of the principal breeds, with descriptive and historical details. The plates of the oldest of these, entitled *British Domestic Animals*, are engraved from drawings by Howe, well known as a good animal painter. Considered in an artistical point of view, they are cleverly executed, although bearing many marks of carelessness and haste; but the subjects are not judiciously selected, and the accompanying text is of little value. The next in order of time is Professor Low's work on *British Domestic Animals*, which is probably known to many of our readers, and of which, as we have no copy beside us for immediate consultation, we shall not at present express any opinion; and, thirdly, Mr Macgillivray's work, which we now propose to notice briefly.

It forms a handsome book, of the size which is technically termed imperial quarto. The first part was published in the beginning of February of the present year, and parts are to appear at intervals of not more than two months, till the whole is completed.

It professes to present a series of authentic portraits of individual animals, considered as characteristic of the various breeds of cattle reared in Britain. These are accompanied with carefully elaborated descriptions, including the peculiarities of the different breeds, the pedigree of the individual selected, the measurements of its parts according to a given scale, and such other details as may be thought directly useful, or in any way interesting. The animals are represented in lithograph engravings, from drawings by an artist who is said to have made such subjects his particular study, and they are carefully coloured.

In the more practical department of the subject, the author means to avail himself of the aid of experienced breeders; what relates to the natural history and general habits of the animals, he is himself most competent to handle. He has been long known as a diligent and successful cultivator of natural history; a close and accurate observer, as well as a correct and perspicuous writer. He is, therefore, entirely in his own province when discussing the natural history of the ox, which he does at some length in the introductory portion of his work. All the known animals of the Bovine family he regards as divisible into a few genera, and even some of these are not very distinct from each other. These genera are, 1st, *Ovibos*, the Musk ox, containing only one well-ascertained species; 2d, *Bison*, the Bison genus, containing six species; 3d, *Bos*, the Bull genus, to which belong the domestic breeds of cattle; 4th, *Bubalus*, the Buffalo genus, containing four or more species; 5th, *Boselaphus*, the Impoofo genus, composed of two species; 6th, *Accelaphus*, the Hartebeest genus, having two species; 7th, *Portax*, the Nilghaw genus, of which only one species is known; 8th, *Catoblepas*, the Gnu genus, containing three species. Of these various animals the author then proceeds to give some account, and, in so doing, we think that he would have greatly facilitated the conception of the distinctive features of the different groups composing the Bovine family, and afforded an interesting means of comparison, had he furnished a wood engraving of an example belonging to each genus. Without some such assistance, a description, however accurate, leaves a very vague image on the mind. The genus *Bos*, the most important to man of the whole family, contains but one species, the common ox, which comprehends three distinct varieties, 1st, *Bos Taurus Caucasicus*, Caucasian or European race, characterised by having a straight spine, hind quarters large, limbs stout, generally short, horns various, directed forwards or wanting: to this variety belong all the European breeds. 2d, *Bos Taurus Indicus*, Indian race, spine nearly straight, but an adipose protuberance, often of great size [illegible] the withers; limbs fine, with small hoofs; horns short or wanting. 3d. *Bos Taurus Africanus*, African breeds, an adipose

prominence on the withers; limbs long and stout; horns generally very long. Comprehending the African breeds, and comparatively little known. From the history of the domestic ox we give the following extract as a specimen of the work:—

Maternal affection is strongly evinced by cows of most domestic breeds; and some of them, should they calve abroad, will not only conceal their young in a suitable place, and betake themselves to it at intervals to afford it nourishment, but will defend it from apprehended injury even against their keepers. Domestic cattle are also attached to each other, and, in certain cases, will not only keep together, but prevent strangers from mingling with them. The bulls, in particular, apparently from jealous feelings, are often watchful of their charge. When the herds of two contiguous farms are set to graze upon a march line, I have seen the bulls all day anxiously walk in front to prevent the cows from intermingling. An anecdote of this kind is told of a bull belonging to a gentleman near Laggan in Scotland. A boy kept watch over the cattle to prevent them from trespassing on the neighbouring corn-fields; but, being lazy, and addicted to sleeping, he often lost sight of his charge, and on such occasions sometimes received merited chastisement. To be revenged, he beat the cattle unmercifully, on which the bull began to drive back the cows when they approached the corn, until, at last, his care of them proved sufficient, and the boy was employed in weeding. Cows often form attachments to individuals, and sometimes will, for some time at least, yield their milk to no other than their favourite. Cattle left to their own resources among the hills exhibit qualities which we would in vain look for among the more strictly domesticated breeds. They will select the most sheltered places in rough weather, avoid the dangerous quagmires, shift their range of pasture judiciously, and in time of snow betake themselves to the farm-yard for a supply of food; or, in some cases, proceed regularly to the ebb in search of algæ. In short, the ox is not naturally so stupid an animal as we generally suppose him to be, although his intelligence seems on the whole inferior to that of the horse.—P. 25.

As the breed to which pre-eminence is now almost universally accorded, Dr Macgillivray first enters upon the consideration of the short-horns, or the Durham or Teeswater breed, as they are frequently termed. As good examples of this race, he figures a bull, named "Billy," the property of J. Irvine Boswell, Esquire, of Balmuto and Kingcausie, which divided the honours at the Highland and Agricultural Society's Show at Aberdeen with the Duke of Buccleuch's "General Picton," and a cow named Peeress, bred by Mr Cruickshank, Sittyton, Aberdeenshire. These portraits are, upon the whole, well executed. It is, however, very difficult to do justice to subjects of this kind by any kind of engraving, and, least of all, by engraving on stone. It fails in giving depth to the general figure, and in bringing out the more delicate undulations of surface, on which the conventional beauty of these animals so much depends. There is a want of clearness also about the finishing of the minuter parts, and the joints of the limbs are for the most part clumsy and inelegant; witness, for example, the hinder legs of the polled black cow in Part V., in other respects a very good portrait. In these respects, perhaps, the artist will improve as he proceeds, although the kind of engraving renders it difficult to be satisfactory in such matters. We may notice, also, one or two inadvertencies on the part of the author, which shew that additional vigilance in his department may not be displaced. In the description of the short-

horned cow, Eau-sucré, in Part III., it is stated, under the head qualities, that her live weight (*eight* days after calving, and a *fortnight* after the portrait was taken) was 120 stones, &c. This implies that the portrait was taken when the cow was in calf, and when we turn to the plate in Part II., where the animal is represented, we certainly find it appearing as if in calf. But then she has another calf, at the same time, lying at her foot. This is a curious anachronism; and if it be said that this is the calf of a former year, why then it is not a calf at all. Besides, short-horns are seldom or never allowed to suckle their calves, and no calf should, therefore, be represented beside a cow of that breed, otherwise there will be a risk of producing a false notion. Again, an error certainly exists in giving the dimensions of the short-horned cow, "Peeress," in Part V., the portrait of which appears in Part IV. The height from the ground to the fore elbow is said to be 2 feet 9 inches, and that from the fore elbow to the top of the shoulders 2 feet 10 inches, making together 5 feet 7 inches. Now the height of back at hooks from ground is represented as being only 4 feet 10 inches, making a difference of height between the front and hinder part of the animal of no less than 9 inches; and yet the portait represents her as remarkably level along the back, which is, no doubt, the case, otherwise she would not be much esteemed. The error probably lies in taking the dimensions.

We may further mention, that the work is very beautifully printed, and all its appurtenances elegant, so that it is fitted at once to form an appropriate ornament to the table of the farm-parlour, and afford solid instruction to the inmates, by the variety, extent, and accuracy of its matter. Of the latter we add a farther specimen, which will be perused with interest:—

Persons whose attention has not been particularly directed towards the various peculiarities of form of different breeds of cattle, would see little difference in cases where the experienced breeder perceives at once the particular qualities which he esteems or disregards. To those who have none of this critical knowledge, or, at least, cannot profess to be judges as to the points which constitute the superiority of the short-horned race, although they are capable of perceiving and admiring beauty in any race, it may be well to direct their attention to some of the most striking features and qualities of this celebrated breed. Beauty, however, is a very undefinable quality, and may exist in very different conditions. A light, agile, fine-featured, small footed Arab girl, and a large, full, sappy, rather heavy, and stout-limbed Belgic lady, may each be beautiful, and yet their points are very different. So a Devonshire cow and a Durham cow may, in the eyes of some admirers of fine stock, be each surpassingly lovely. The Durham race is of the Dutch make, and probably of Dutch origin, and it differs from the hill breeds of the west, just as much as an Aberdeen porter differs from a Lochaber gilly, or the chief magistrate of a Teutonic corporation from the prince of a Caucasian tribe. He who admires the elegant forms of the Italian greyhound, the gazelle, and the cheetah, may wonder at the raptures excited by the inspection of an ox, remarkable, in his eyes, for its vast unwieldy carcass, propped on four short stumps; but utility is the object sought for, and, when attained, becomes so associated with the idea of perfection, that, in the mind of the breeder, the one implies the other; and, besides, the more perfect the animal as to its useful qualities, the more will it assume a certain kind

of beauty. I am indebted for the following description of the Durham type to a gentleman whose knowledge of the subject will not be questioned.

When a pure-bred short-horn is looked upon at some little distance, one is struck with the roundness and mouldiness of the whole frame of the animal; there is nothing angular or rugged about it. On approaching nearer, he admires the beautiful long silky coat, and the full, prominent, yet mild eye. Unlike every other breed of cattle, they are, in fact, naturally tame and docile. Instead of flying from man, or fiercely attacking any one who may go near them, they will remain quietly where they may be, in meadow or yard, waiting to be caressed or made of. It is very rare to see a savage animal among the short-horned cattle; even the bulls are, generally speaking, uncommonly gentle. When examined by the hand, they feel soft and mellow; they all handle as if they were fat, even when in comparatively low condition; and, when they have been pampered to the highest pitch of obesity, they retain the beauty of their form more than any other breed in a similar state, laying on fat equally all over the body, so that, in Yorkshire phrase, they are called "level beasts," that is, not lumpy. They will keep in good condition on a wonderfully small quantity of food, provided they be dry; and thus, while other breeds were famishing on bare pastures, during the summer of 1826, the short-horns were in good order. But they are very impatient of wet, and dislike rough weather, so that shelter from rain and wind appears to be absolutely necessary for their prosperity, although cold does not appear to injure them. In point of early maturity they are unrivalled, as may be exemplified by the "Durham ox," which, when three years old, was computed to weigh 100 stone of 14 lbs. The prices which have been paid for bulls of this breed have been far beyond what was ever before given. The famous bull, "Comet," brought 1000 guineas; Mr Mason of Chilton's "Monarch," 750 guineas; and Thomas Bates, Esq. of Kirklevington, refused the enormous sum of L.2000 for his bull, "Duke of Northumberland," to go to America. As superior milkers, they are well known to the London dairymen, who call them Yorkshire cows, and prefer them to all others—hundreds of them being bought, for the milk only, every year, by Laycock, Proctor, and the other great cow-keepers of the metropolis. Mr Bates, who, at the present moment, is the oldest breeder of this tribe of cattle, and is allowed on all hands to have, as a whole, the finest herd of them now in existence, states, in his letter to the Editor of the "New Farmers' Journal," that, in June 1807, his first "Duchess" calved at Halton Castle in Northumberland, and being fed on grass only, made, for several months, in milk and butter, above two guineas per week.—P. 44, 45.

Over-liming Land. By Henry Chaytor, Esq., Clervaux Castle, Darlington.—If I had not previously known the value of science to agriculture, I could not, after reading the valuable paper by Professor Johnston, from the Agricultural Chemical Association, "On the Over-liming of the Land," have withheld my assent to its utility. As my views, however, on one or two points relating to this subject, differ considerably from those of the learned professor, I venture to lay them before the public for affirmation or rejection.

I am perfectly satisfied that an application of lime would assist, more or less, in producing the effect complained of, but still I am by no means sure that the lime was really to blame. Taking the soils of Ballindalloch into consideration—it is necessary to know, before we can come to a just conclusion, the general state of cultivation before the lime was applied, and the tillage, manure, and cropping since. This information it may be difficult, most probably impossible, to obtain, but I think it will be easy to draw inferences from what we do know that may not be deemed unreasonable. It is probable that, before the application, the land was deficient in lime, that too much in a caustic state was ap-

plied, and, as the professor surmises, the occupier was tempted, by large returns, to an improper cropping. But I think that, *under the same management*, the soil would have been in *nearly the same mechanical state* if lime had never been applied at all. The farmer *generally* considers that the only benefit to be obtained from a bare fallow is the extirpation of weeds; but well-informed persons are aware that this is very far short of the truth. Now, light land, being easily cleaned, gets very little ploughing, and the consequence is, that it is left for sowing in the lightest possible state. *If ploughed at all*, it cannot be ploughed too often; the reasons why, I will presently give. But the continued application of fold-yard manure has a *very great effect in loosening land*, and the quantity of vegetable matter in the soils of Ballindalloch seems to indicate its extensive use. But, however this may be, it appears that the evil effects did not *immediately follow* the application of lime, as "several good crops were taken;" this, therefore, must mean *several years*, by which time we may conclude it would be *much diminished in quantity*, as, from such a soil, it would rapidly disappear.

I can scarcely ascribe any evil action to the frost, unless it was actually saturated with water at the time; for it is certain that strong clays are most affected by it, as may be easily seen by walking over them in *dry* weather in the spring, where the foot will often sink several inches if the frost has been severe; and also that a sandy soil is just what we prefer to cover our potato-heaps in winter, as the frost cannot penetrate it.

In addition to Professor Johnston's recommendations to fold sheep, rolling, mild lime in small quantities, I beg to prescribe as follows:—

1°. *When it is ploughed*, to plough as *much as possible* and *harrow it well*. This, which seems contrary to the general opinion, I arrive at by observing that, if a vessel is filled with dry sand or gunpowder, any agitation tends to make it occupy less space, and that if a hole is dug in dry light land, the soil taken out is not sufficient to fill it up again, and yet the spade is considered a better pulverizer than the plough. It is therefore *too little* and not too much working that it gets. I beg to suggest that experiments should be tried to determine the *value* of various ploughings, &c. The results would, no doubt, be valuable, and trials should be made both with and without manure. The evil has always been in considering the bare fallows perfected *when clean*—at least such is the practice in my part of the country—and in reading agricultural writings, the authors should always be considered as speaking of their own district when they do not specify otherwise.

2°. To sow the cereal crops *without ploughing at all*, when it can be done, merely scarifying and harrowing. This must be

left to the judgment of the farmer, and will mainly depend on his land *being clean.*

3°. To avoid the use of fold-yard manure as much as possible, using only such as is very well fermented, and, when convenient, to mix it with soil or clay, no matter how bad it may be, and if in situations remote from the sea, about 1 bushel of salt to every ten loads, and never exceed 10 or 12 tons of manure per acre at one application.

4°. To use in *preference* night soil, bones, and artificial manures, or a combination of them with moderate quantities of fold-yard manure, (though this seems to answer *generally.*)

5°. Clay *of any quality*, if obtainable near, might be thrown on in lumps *in autumn.* The frost would cause it to fall, and leave it in a good state to harrow in in the spring.

It seems clear, from all that has been said and done about lime, that it should be very cautiously used on light land, and that even on strong land great damage *may* be done though it might not be perceived. Last summer I applied 120 bushels per acre to 24 acres, but I am convinced it was not *economical* to do so. The land was strong clay, and not drained. I intend in future to drain first, and make more moderate applications and oftener. I am convinced that the great value of some limestones depends on the phosphoric acid they contain, though I certainly do not, like Liebig, estimate the value of *turnips* by the quantity of this substance they contain.

MISCELLANEOUS NOTICES.

I. *New Clover.*—Two new clovers have been attracting attention in France, concerning which we find some information by M. Vilmorin, in the "*Bon Jardinier*"—one is the Hybrid and the other the Elegant. Elegant Clover was for some time considered identical with one called T. hybridum, cultivated in Sweden; when, however, growing together, the differences are striking: the latter is larger in all its parts than the former, and the colour of its flowers is a brighter rose, shaded with white in the centre, while the Elegant Trefoil has rather dull reddish rose blossoms, coloured alike in every part of the flowerhead. The appearance of the herbage is different: the Hybrid clover has bright and dark foliage, and that of the Elegant is pale and unequal; the leaflets of the latter are also marked with a brown band like common clover, which is not the case with the Hybrid. Another character of the Hybrid is that, in the summer, when it begins to shed its blossom, and during the autumn, the root throws out fresh foliage, arranged like a rosette; but in the Elegant Trefoil this does not occur: it is the lateral branches which rest on the ground that supply the verdure. The Hybrid Trefoil also flowers fifteen days earlier than the other, which, however, lasts the longest, and branches more; lastly, the former is taller, more beautiful, and comes in earlier; but when the latter has arrived at perfection, having more numerous stems, well covered with branches, and more solid, it will, when mown, yield as great a produce as the former. The Hybrid Trefoil has been a great deal used by M. de Kruns in the formation of artificial fields at Orebro in Sweden, and it has succeeded well; it has grown from three to four feet high, and has yielded, during about twenty years, often more than 10,000 pounds per tunnland, (about an acre and a quarter English,) and always upwards of 5,000 for the first ten years. It is regarded as a plant equally suitable to cultivate for mowing and for pasturage; strong moist soils, argillaceou or calcareous, suit it well; it frequently comes spontaneously on lands in Swede

that have been drained. The Elegant Trefoil is found in abundance on poor clayey strong soils, where it grows thick and vigorous; it is wild in France in many places, not unfrequently in ferruginous sand. It seems very probable that the species will one day form valuable additions to our forage plants, as they appear as though they would succeed on land unsuitable for Clover, Lucerne, and Sainfoin.

II. *Economical Husbandry.*—The Rev. Mr Gillespie, minister of Cummertrees, planted in spring, a week or so earlier than usual, an acre of potatoes, after as careful a selection of seed as possible. Previously he had provided a Winchester bushel of beans. When the drills were drawn, the manure spread, and the seed laid in, a bean was placed between every two of the sets; and, this task performed, he had nearly a half of the pulse remaining, which he distributed among the neighbouring cottagers, with a recommendation to try the same experiment. The beans, as may be supposed, were first above ground; and, as they had made some head before tendrils of a different kind appeared, they protected the potatoes during the earlier part of the season, and proved a special shelter during the cold weather in May. At topping-time, the stalks stood four feet high, and are so rich in well-formed pods, that the grower confidently reckons on a crop of pulse worth at least £10. The blooming tubers have thriven in proportion, and, at reaping time, the acre of ground thus cropped will prove the most productive ever cultivated on the glebe of Cummertrees. The experiments of the cottagers proved equally successful; and in submitting the above statement, as verbally communicated by the reverend gentleman on Lockerby-hill, we trust that it is one that will not be thrown away on the public. It is well to be prepared for the worst; in case of partial failure, the beans will bloom and pod for the good of the pot, in sections of land more open to the influence of the elements than an enclosed garden. Under different circumstances, individuals may have a double crop, and although one objection may be urged—the exhaustion which proceeds from over-cropping—how easy for a farmer, where oats or barley follow, to maintain and restore equilibrium by extra manure, such as guano mixed with ashes or common dung.—*Dumfries Courier.*

AGRICULTURAL REPORT.

September 1845.

Almost immediately after the date of our last report, the weather changed decidedly for the worse. The rain increased until it fell daily, and, as a consequence, the temperature went down, aggravated by the wind coming from the east and north-east in a confirmed manner. Cold and wetness together form but a poor encouragement to vegetation, and yet we could not fail to remark that, notwithstanding the disagreeable coldness of the air to the feelings, the thermometer ranged as high as 55° to 65°, and the crops increased in straw. It would seem, from these facts, that the temperature of the air, as measured by the thermometer, may produce, at the same time, a very different effect on the feelings of man and the growth of plants. It would seem that plants will grow well if the absolute temperature of the air, as measured by the thermometer, is not under 55°, and if it be as high as 65° they will thrive apace, while the feelings of man may be rendered disagreeable at those temperatures; because these are affected relatively, according to the state in which the air is when it is felt. Thus, a damp air fanned upon the skin by an east wind always produces a disagreeably cold sensation, though the temperature may be pretty high as indicated by the thermometer, while these are favourable conditions of the atmo- [illegible] to the growth of plants.

But, both absolutely and relatively, the temperature has been low during the whole summer; it has always felt as on a good day in winter—the sun warm while it shone, and the air agreeable in sheltered situations, but the moment the wind was felt, it produced the sensation of a cool frosty air. The blue vault, when seen, seemed as blue, and sharp, and clear, as in a frosty day in winter. Explanation of this state of the air over our island in summer may not be easy; but a fact has lately come to our knowledge which assists to explain it in a satisfactory manner, and the explanation is this. The ordinary current of the atmosphere in the northern hemisphere is from the equator to the pole along its upper part, and from the pole to the equator along the surface of the earth. Both currents are slow; and the upper one is constant, finding nothing to obstruct its course, but the under current is liable to be deflected by many casualties, such as the obstruction of mountains, and the superior force of stronger currents from opposite and lateral directions. In summer, the lateral currents usually prevail over the regular, and hence west and east winds prevail in that season over the north wind. But during this summer, the north-east wind has greatly prevailed—indeed it has almost been constant—and why? The tender which accompanied the north-west expedition under Sir John Franklin, brought word that the summer has been unusually fine in Greenland and Davis Straits, so much so, that the temperature stood as high, night and day, as 43°, and, as a consequence, the ice was only seen in icebergs, and the water was open and smooth. One favourable result of this state of the northern sea may be, that the whale ships shall have penetrated to very high latitudes, and will come home with a successful fishing. Now a high state of temperature in those regions cannot have failed to create currents from quarters which have only experienced their ordinary temperature, and thus a powerful current would set in towards Davis Straits, along the Northern Ocean, as far as the Arctic Ocean, and it would be constant as long as the temperature continued high in the Straits. Hence, that current would be from the north-east, and though Davis Straits are to the west of this island, that same current would come from the north-east to us in its passage to the Straits, inasmuch as the straits are in the 60th degree of latitude, and 50° *west*, and the Arctic Ocean extends from the 70th to the 80th degrees of latitude, and is 60° to the *east* of us.

On the 22d of August the rain ceased. The sun has since appeared frequently, and for a few days the heat was considerable, 70° in the shade; but though the clear and dry weather has continued, the temperature has again descended to 50° and 55°, and the air feels chilly and even frosty, the thermometer going during the night at times as low as 45°. Since the last few days to this

date, (19th,) the barometer has fallen from 30 to 29 inches, and heavy showers have followed the indication. There have been but few instances of electric disturbance during the summer. We shall now endeavour to describe the effects of the weather on the crops.

The straw of all kinds of grain is bulky. The wheat, however, from the dampness of the season, must be of inferior quality, though the quantity on dry or drained land may be considerable; and yet even there, where it has been affected with rust, and much laid, it cannot yield abundantly. The wheat everywhere is not so much laid as might have been expected, and it is only a hope that the later portion of it which was sown in spring will derive benefit from the dry clear weather, though some of it is still green, and will, we fear, be of little use for bread. The wheat that has been thrashed from the stook does not weigh above 56 lb. to 60 lb. per bushel.

The barley was first ready for the harvest, and has fallen heavy before the sickle. The grain cannot, perhaps, be of the bright colour so desired by malsters, still, on the dry soils, it is of good quality, and everywhere it yields largely. We have heard of samples already as much as 56 lb. per bushel.

The oats have been generally ready in the low country before the wheat; but in the high districts, such has been the uniform lowness of the temperature, that they are still green, though full and ready for the ripening. Should the frost keep off they will yield largely, but should it set in so early as to whiten the crop into ripeness, the yield, of course, will be seriously injured. The fate of the oats in the high districts is, therefore, entirely dependant on the state of the weather for the ensuing fortnight. We do not remember observing so uniformly a heavy crop of oats in the high country as this one presents. For our own parts, knowing that green oats will ripen in the stook, we would much prefer to cut them down in a green state, than allow them to stand to be frosted, after unequivocal symptoms of frost have been indicated.

Beans and pease will supply more straw than grain this season, though the beans have made a very rapid improvement in the dry weather for the last fortnight.

The hay, as anticipated, has proved an abundant crop, and, in consequence, its price is low; we have heard as low as 5d. per stone of 22 lbs.; and in many parts of the country growers prefer keeping it in their own hands to parting with it at so low a price, from a conviction that, in the progress of railway operations in the ensuing winter, hay will be in demand—an anticipation that seems to be well-founded. The quality of what we have seen is good, though the weather at the time of its making was wet; and this confirms what we have always observed, that

a plant well developed in all its parts is much more easily prepared for keeping, even in the midst of adverse circumstances, than our fears allow us to believe.

The aftermath has not proved so full as the previous flourishing state of the grass would have led us to expect; and we ascribe this result more to the management of the grass than to the state of the weather. In the hope of the weather becoming better, the grass for hay was, in many cases, naturally delayed to be cut, and the aftermath was thin and short, as might have been anticipated; because, when clover and rye-grass get leave to stand till nearly arrived at maturity, they either do not re-appear, or grow as if exhausted.

The pasture has continued to hold out vigorously during the summer, it never having been in the power of the grazier to overstock the fields. Two happy results will follow from this state of the pasture: the stock will gain high condition, and, having been turned out in a good state from last winter, this is a consummation that will be obtained without difficulty, and the land, moreover, will be in excellent heart for the ensuing crop next spring.

The potatoes having had a moist bed, and having received abundance of moisture in the most vigorous part of their growth, we have heard of no instance of ordinary failure among them, a disease becoming too familiar to us. Doubtless, the rain will have caused the tubers to swell to an inordinate size, and this, we fear, will be no advantage to their keeping in the pits in the ensuing winter; but we believe the potatoes in dry soils will prove very farinaceous. The dry weather came in good time to give firmness to the tuber; but such is the growing state of the stems, that unless early frost cut them down prematurely, we suspect they will be long of dying a natural death, and this may cause the crop to be delayed in the taking up. Indeed the harvest operations being late, it will not be possible to attend early to the potato harvest.

We hear of a disease amongst the potatoes in the south of England of the most alarming description. It has been called the *potato murrain*. It first affects the edges of the leaves, blackening them, then the stems become shrivelled, and both die, leaves and stems, and, last of all, the tubers rot in the ground. The most obvious cause of the rottenness of the tuber is the wet state of the soil and weather; and the low temperature fully accounts for the deficient growth which the plants exhibit, and their consequent death; and this is the explanation, without entering into particulars, which has been given for the appearance of the disease by a very competent authority. It is said to be confined to the south of England, which we doubt, as it has been observed in Ayrshire, in the

neighbourhood of Maybole, and it has also made its appearance in Ireland. The remedial measure recommended against the recurrence of this disease is drainage of the ground, and this is so far good; but unless the draining render the soil perfectly dry, that is, as dry as naturally dry soil, which carries away the water in fast as it falls, the cure will not be effectual—and this result cannot be obtained on clay soils by drainage. The only remedy to prevent the contagion from spreading is to take up the entire crop immediately, and separate the affected tubers from the sound.

The young braird of the turnips came away quickly and vigorously, and it required all the dexterity of the farmer to keep pace in his implemental operations with the growth of the plant. The earliest sown suffered by too much wet, having *set up*, as it is phrased; and we suspect that the subsequent dry weather will not altogether recover them to vigour of growth. Still they form but a small minority of the crop, the greater part of which are excellent, and there is no doubt that the fine autumnal months of September and October, when the bulbs are always formed, will ensure a great and extensive crop.

The clip of wool has turned out as we anticipated; that of Scotland has been both great and good, while that in England is indifferent. There never perhaps was a season in which the beneficial influence of abundance of good food on the growth of wool was so strikingly displayed as in this, and the result should stimulate store-farmers, in the high as well as in the low country, to use every means in their power, and even to create means, to support their sheep-stock uniformly in the best condition throughout the year. Such a result is not always in their power to command, but it is much more so than many of them imagine, and which they, therefore, do not attempt by extraneous means to realize. The ruling prices will be seen in the Table.

The price of butcher-meat still continues high, both beef and mutton varying from 5s. 6d. to 8s. 3d. per stone of 14 lb., as may be seen in the Table, notwithstanding that the pasture has been most abundant throughout the kingdom all the summer. It is still the demand from England that keeps up the prices; and this was strikingly evinced in the September Tryst at Falkirk, when the quantity of stock exhibited was much below the usual number, owing to the English dealers having bought the most suitable lots before they reached the market-field. It is interesting to compare the high prices with the importation of live stock from abroad. According to Mr W. E. Gladstone the importation in the first six months of 1842 were—

[illegible]	[illegible]	
[illegible]	10	
[illegible]	[illegible]486	when prices were very low.

In 1843,

Cattle,	1482	
Swine and hogs,	361	
In all,	1843	when prices were still low.

And in 1844,

Cattle,	4865	
Swine and hogs only,	271*	
In all,	5136	when prices became high.

And from a statement which has been sent us, it appears that, when the prices still continued high, the importation in 1845 to 5th August, was

Cattle,	7490
Sheep,	1985
Swine,	311
Making a total of	9786

From these facts, these deductions may be fairly drawn, that when prices of butcher-meat are low, the importation of live stock from abroad will be small—that when they become high, the importation will increase—that the largest importation as yet has made no sensible effect on prices ; and this last conclusion is the most important, and that in which both agriculturists and consumers are most interested. We have no expectation that these high prices will be obtained in the ensuing winter, as the turnips promise a good crop in England, and both straw and hay are abundant; and yet a counteracting influence may be found to prevent much reduction in the price, in the continued and even increasing demand for butcher-meat by the manufacturing and commercial population.

There have been some fluctuation in the prices of corn during the quarter, in consequence, no doubt, of the alarming state of the weather up to a recent period, and even after the harvest had commenced in England. The extreme deviation, however, has not exceeded 9s. 11d. per quarter, the highest aggregate average price being 55s. 1d., and the lowest 52s. 2d. per quarter, the highest price being still moderate. The present duty is 17s. per quarter. It is supposed that the prices have already reached their maximum, and that the duty will not fall below 17s., and indeed a reaction downwards has already taken place in the weekly average, so certain is the prospect of abundance. Still a little *fine* foreign wheat would be of service to mix amongst our own of this crop, which is not of the first description, nor so fine as the English wheat of last year. The stock of foreign wheat in bond on 5th August last, was 411,387 quarters, and we need not look for a supply from Dantzig, the crop in Poland having failed this season. This circumstance is the more to be re-

* Gladstone's Remarks on Recent Commercial Legislation, p. 48.

gretted, for our own sakes, since the quantity of old wheat in the hands of the farmers is not large, as has been reported.

The produce, however, of this country, as regards quantity, is still matter of conjecture. All we know as yet is, that there is abundance of food in the country for man and beast; and, though the harvest is late, we have the consolation in hoping that the next will be an earlier one, and that, therefore, the present one will have less time than a twelvemonth to supply.

The FIARS PRICES of the County of BUTE had not reached us when we gave the usual Table of those Prices in our last Number for July 1845. *We supply the omission as follows:—*

Wheat per Imperial Quarter, . .	44/2¾	Pease, per Imperial Quarter, . .	39/
Barley, ...	29/6	Beans, ...	39/
Bear, ...	26/	Oatmeal, per 140 lbs. per do. . . .	14/9¼
Oats, ...	18/2¼		

ERRATUM.

We also take this opportunity of correcting an Error of the Press, occasioned by the dropping out of a figure, in the Fiars Prices of the County of LANARK, p. 40, No. 9, for July 1845. ***Instead*** **of Oatmeal per 140 lbs. 1/3¼,** ***read*** **15/3¼.**

THE REVENUE.

ABSTRACT of the Nett Produce of the Revenue of Great Britain, in the Quarters and Years ended on the 5th *of July* 1844 *and* 5th *of July* 1845*—shewing the Increase and Decrease on each head thereof.*

	Quarters ending July 5. 1844.	Quarters ending July 5. 1845.	Increase.	Decrease.	Year ending July 5. 1844.	Year ending July 5. 1845.	Increase.	Decrease.
	L.	L.	L.	L.	L.	L.	L.	L.
Customs, ...	4,869,235	4,499,548	. .	369,687	19,770,158	19,807,044	36,886	. .
Excise, ...	3,115,592	2,965,684	. .	149,908	11,965,602	12,074,909	109,307	. .
Stamps, ...	1,705,063	1,837,076	132,013	. .	6,518,063	6,846,983	328,920	. .
Taxes, ...	1,989,874	2,000,567	10,693	. .	4,197,516	4,228,441	30,925	. .
Post-Office, . .	155,000	155,000	. .	. .	632,000	679,000	47,000	. .
Miscellaneous, .	452,187	43,652	. .	408,535	638,140	783,819	145,679	. .
Property Tax, .	752,485	909,991	157,506	. .	5,247,663	5,261,954	14,291	. .
	13,039,406	12,471,518	300,242	928,130	48,969,202	49,742,141	712,908	
	Deduct Increase,			300,242	Deduct Decrease,			
	Decrease on the Qr.			627,888	Increase on the Year,		712,908	

FOREIGN MARKETS, per Imperial Quarter, free on Board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1845.							
June.	Danzig.	29/9 to 36/6	17/6 to 21/6	10/6 to 12/6	22/6 to 28/	28/6 to 33/6	28/ to 32/
July.	..	35/ 41/9	18/ 22/6	11/ 14/	27/ 30/	29/ 34/	29/6 35/
Aug.	..	36/ 45/6	19/6 24/	12/6 14/6	29/6 36/6	30/ 35/	30/6 38/
June.	Hamburg.	28/6 33/6	19/6 21/9	12/6 15/	22/ 27/	21/6 24/6	22/6 27/
July.	..	27/6 35/3	18/ 20/9	11/6 14/3	24/ 28/6	23/6 26/9	24/ 27/6
Aug.	..	32/6 42/6	19/6 23/9	12/6 14/6	26/6 30/6	24/6 30/6	25/ 32/
June.	Bremen.	33/6 37/6	20/6 24/	12/9 15/	24/ 28/6	26/ 32/	27/6 35/
July.	..	35/ 42/	22/6 26/	13/ 16/	28/ 32/	32/ 40/	30/ 38/6
Aug.	..	37/ 40/	20/ 24/	11/9 14/	29/6 33/6	30/ 37/6	28/ 36/
June.	Konigsburg.	27/9 33/6	16/ 18/6	12/6 14/6	19/6 25/	22/6 27/6	28/6 34/6
July.	..	32/6 40/6	18/6 22/9	13/ 15/	20/9 28/	24/ 30/6	30/ 36/6
Aug.	..	39/8 45/4	17/ 21/	12/9 14/	22/6 30/	29/ 36/	29/6 35/6

…ght from … 4/6 pe… Qu…ter to Great Britain.

TABLE OF PRICES, &c.

ge Prices of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets:—

LONDON.

Vheat. s. d.	Barley. s. d.	Oats. s. d.	Rye. s. d.	Pease. s. d.	Beans. s. d.
51 2	29 11	22 2	30 6	37 2	36 0
52 0	28 0	23 0	31 4	37 6	37 0
51 8	29 6	23 2	31 2	37 4	37 10
49 9	28 10	23 7	30 10	37 6	39 7
51 9	31 7	22 9	31 3	38 1	38 3
52 6	31 2	22 3	31 10	38 6	39 5
51 8	28 10	22 8	32 2	38 10	40 2
55 0	29 1	22 3	32 6	39 3	41 8
56 2	31 8	22 4	32 3	39 8	41 5
58 9	30 0	22 9	32 10	39 11	42 4
61 5	29 10	22 1	33 2	40 3	42 2
60 1	28 7	22 3	33 6	40 6	39 5
60 11	29 11	21 10	34 0	40 8	42 10

EDINBURGH.

Date.	Wheat. s. d.	Barley. s. d.	Oats. s. d.	Pease. s. d.	Beans. s. d.
1845. June 4.	48 9	30 9	24 2	38 6	40 0
11.	49 9	30 6	25 2	38 4	39 1
18.	49 6	30 0	23 9	39 0	39 10
25.	48 11	31 10	22 8	38 6	39 0
July 2.	50 7	29 5	24 0	38 0	38 9
9.	51 11	30 8	23 9	39 0	39 8
16.	53 0	30 7	28 0	42 0	44 0
23.	55 6	33 0	25 2	43 0	44 0
30.	62 0	34 6	26 1	41 6	42 4
Aug 6.	55 8	30 0	26 4	41 8	42 3
13.	55 10	31 10	25 9	43 2	41 6
20.	59 5	31 7	28 10	47 6	48 8
27.	59 6	31 6	28 9	47 0	48 2

LIVERPOOL.

	Wheat. s. d.	Barley. s. d.	Oats. s. d.	Rye. s. d.	Pease. s. d.	Beans. s. d.
7.	46 2	26 10	21 9	32 4	38 4	38 7
4.	45 10	25 7	20 5	32 10	37 6	37 9
1.	45 6	26 6	20 7	33 0	38 2	38 4
8.	45 6	25 4	21 3	32 4	38 6	41 5
5.	44 2	26 1	20 2	31 9	39 4	38 6
2.	47 6	25 10	20 5	32 6	39 6	41 9
9.	45 2	26 2	20 7	31 6	40 2	39 5
6.	46 8	26 1	20 6	33 10	40 6	41 0
2.	48 9	26 9	20 7	34 6	41 4	40 7
9.	50 9	25 10	21 1	34 4	40 8	43 2
16.	52 9	27 2	21 5	33 8	39 6	43 0
23.	54 0	28 1	23 1	33 4	39 2	43 1
30.	54 4	26 2	22 9	33 6	38 10	45 4

DUBLIN.

Date.	Wheat per Barrel 20 st. s. d.	Barley per Barrel 16 st. s. d.	Bere per Barrel 17 st. s. d.	Oats per Barrel 14 st. s. d.	Flour per Barrel 9 st. s. d.
1845. June 7.	24 8	14 0	10 6	12 2	14 10
14.	25 9	14 2	10 8	12 6	14 9
21.	25 7	14 0	10 7	12 1	14 11
28.	25 0	13 10	10 0	12 3	15 2
July 5.	25 8	14 2	10 6	12 4	15 4
12.	26 0	14 6	10 8	12 7	15 6
19.	27 2	14 4	10 10	12 5	15 10
26.	26 7	14 8	11 2	12 8	15 5
Aug. 2.	29 10	14 7	11 1	12 9	16 0
9.	31 0	14 3	11 2	12 10	16 4
16.	32 6	14 4	11 1	12 3	16 9
23.	32 1	14 9	11 3	12 7	17 9
30.	31 0	14 6	11 6	13 3	17 3

E shewing the Weekly Average Prices of GRAIN, made up in terms of 7th and 8th Geo. IV., 58, and 5th Vict., c. 14, and the Aggregate Averages which regulate the Duties payable on OREIGN CORN: the Duties payable thereon, from June to August 1845.

Wheat. Weekly Average. s. d.	Wheat. Aggregate Average. s. d.	Wheat. Duty. s. d.	Barley. Weekly Average. s. d.	Barley. Aggregate Average. s. d.	Barley. Duty. s. d.	Oats. Weekly Average. s. d.	Oats. Aggregate Average. s. d.	Oats. Duty. s. d.	Rye. Weekly Average. s. d.	Rye. Aggregate Average. s. d.	Rye. Duty. s. d.	Pease. Weekly Average. s. d.	Pease. Aggregate Average. s. d.	Pease. Duty. s. d.	Beans. Weekly Average. s. d.	Beans. Aggregate Average. s. d.	Beans. Duty. s. d.
47 7	45 9	20 0	30 2	30 2	8 0	22 2	21 10	6 0	33 0	30 9	10 6	38 1	37 1	5 6	38 0	37 2	5 6
48 2	46 7	20 0	30 3	30 1	8 0	22 8	22 1	6 0	31 4	31 1	10 6	37 0	37 2	5 6	38 1	37 6	5 6
47 10	46 11	20 0	29 9	29 11	9 0	22 7	22 3	6 0	31 2	31 0	10 6	38 6	37 5	5 6	38 6	37 9	5 6
47 11	47 3	20 0	29 7	29 10	9 0	23 2	22 6	6 0	32 1	31 5	10 6	38 3	37 8	5 6	39 3	38 1	4 6
47 10	47 7	20 0	29 10	29 10	9 0	22 8	22 7	6 0	31 0	31 6	10 6	39 5	37 7	5 6	38 10	38 4	4 6
48 10	48 1	20 0	29 0	29 9	9 0	22 6	22 8	6 0	33 11	32 1	10 6	38 11	38 4	4 6	39 8	38 9	4 6
50 0	48 5	20 0	29 6	29 8	9 0	22 4	22 9	6 0	32 8	32 0	10 6	40 2	38 8	4 6	39 9	39 0	3 6
51 7	49 0	20 0	29 2	29 6	9 0	22 5	22 7	6 0	31 7	32 1	10 6	38 10	39 0	3 0	40 3	39 4	3 6
53 3	49 11	20 0	29 6	29 5	9 0	22 6	22 8	6 0	34 6	32 8	10 6	41 0	39 5	3 6	40 5	39 8	3 6
55 9	51 9	19 0	29 7	29 6	9 0	22 8	22 6	6 0	33 10	32 11	10 6	39 0	39 6	3 6	41 0	40 0	3 6
57 0	52 8	18 0	29 4	29 4	9 0	22 2	22 5	6 0	34 4	33 6	9 6	39 7	39 7	3 6	41 2	40 4	2 6
57 2	54 0	18 0	29 9	29 6	9 0	22 8	22 6	6 0	33 4	33 5	9 6	38 11	39 6	3 6	41 8	40 8	2 6
56 6	55 1	17 0	30 0	29 7	9 0	22 4	22 8	6 0	35 7	33 10	9 6	38 4	39 3	3 6	42 1	41 1	1 0

The MONTHLY RETURNS, published in terms of 9th Geo. IV., c. 60, shewing the Quanti Corn, Grain, Meal, and Flour imported into the United Kingdom in each Month ; the Qu upon which duties have been paid for home-consumption, during the same Month ; and the tities remaining in Warehouse at the close thereof, from 5th June to 5th August 1845.

Month ending	IMPORTED. From Foreign Countries.	IMPORTED. From British Possessions.	IMPORTED. Total.	CHARGED WITH DUTY. From Foreign Countries.	CHARGED WITH DUTY. From British Possessions.	CHARGED WITH DUTY. Total.	REMAINING IN WAREHOU[SE] From Foreign Countries.	REMAINING IN WAREHOU[SE] From British Possessions.	T[otal]
	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu	Qrs. Bu	Q
June 5, 1845. Wheat, .	54,294 2	1,080 5	55,374 7	3,290 2	1,790 4	5,080 6	320,188 6	92 4	320,
Barley, .	119,862 4	. .	119,862 4	107,028 4	. .	107,028 4	18,972 4	. .	18,
Oats, . .	85,596 6	. .	85,596 6	67,161 5	. .	67,161 5	73,680 3	. .	73,
Rye, . . .	7 4	. .	7 4	7 4	. .	7 4	294 1	. .	
Pease, .	7,553 7	. .	7,553 7	2,915 3	. .	2,915 3	9,616 5	. .	9,
Beans, .	23,686 3	. .	23,686 3	4,671 5	. .	4,671 5	37,100 2	. .	37,
Totals,	291,001 2	1,080 5	292,081 7	185,074 7	1,790 4	186,865 3	459,852 5	92 4	459,
July 5, 1845. Wheat, .	63,098 3	7,078 7	70,175 2	1,103 2	7,065 3	8,168 5	365,597 6	10 6	365,
Barley, .	37,751 4	. .	37,751 4	8,564 4	. .	8,564 4	47,318 3	. .	47,
Oats, . .	71,348 6	850 4	72,199 2	46,633 3	850 7	47,484 2	95,566 5	. .	95,
Rye, . .	1 6	. .	1 6	1 6	. .	1 6	. .	. .	.
Pease, . .	8,366 4	3,145 5	11,512 1	991 5	2,700 5	3,692 2	13,010 2	445 4	13,
Beans, . .	15,004 3	. .	15,004 3	5,648 1	. .	5,648 1	46,528 7	. .	46,
Totals,	195,569 2	11,075 0	206,644 2	62,942 5	10,616 7	73,559 4	508,021 7	456 2	568,
Aug 5, 1845. Wheat, .	55,093 6	5,372 6	60,466 4	884 4	5,384 6	6,269 2	411,204 6	92 4	411,
Barley, .	9,008 2	0 4	9,008 6	1,306 6	. .	1,306 6	57,714 2	. .	57,
Oats, . .	65,750 4	3,976 2	69,735 6	60,830 2	3,809 4	64,639 6	98,589 4	166 3	96,
Rye, . .	. .	. .	. .	. .	. .	. .	. .	. .	.
Pease, .	3,260 1	4,211 3	7,471 4	3,297 3	4,656 4	7,953 7	12,607 5	. .	12,
Beans, .	20,143 5	2 5	20,146 2	11,039 5	2 5	11,042 2	55,580 2	. .	55,
Totals,	153,265 2	13,563 4	166,828 6	77,358 4	13,853 3	91,211 7	635,786 3	258 7	636,
	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt. qr. lb	cwt
June 5, 1845. Flour, .	716 1 16	. .	716 1 16	348 1 12	2,661 2 21	3,010 0 5	230,505 1 8	2,510 3 16	233,0
Oatmeal,	535 2 14	. .	535 2 14	. .	. .	. .	160 2 11	2 2 22	1
Totals,	1,252 0 2	. .	1,252 0 2	348 1 12	2,661 2 21	3,010 0 5	230,665 3 19	2,513 2 10	233,1
July 5, 1845. Flour, . .	3,078 3 11	75,522 2 6	78,601 1 17	320 3 16	74,874 1 22	75,195 1 10	223,428 1 6	3,177 3 20	226,6
Oatmeal,	. .	. .	. .	. .	. .	. .	160 2 11	2 2 22	1
Totals,	3,078 3 11	75,522 2 6	78,601 1 17	320 3 16	74,874 1 22	75,195 1 10	223,588 3 17	3,180 2 14	226,7
Aug. 5, 1845. Flour, . .	642 2 18	95,190 2 9	95,833 0 27	80 3 6	95,693 2 20	95,774 1 26	221,914 1 18	2,717 2 11	224,6
Oatmeal,	12 3 6	985 1 24	998 1 2	. .	985 1 16	985 1 16	7 2 14	2 2 22	
Totals,	655 1 24	96,176 0 5	96,831 2 1	80 3 6	96,679 0 8	96,759 3 14	221,922 0 4	2,720 1 5	224,6

PRICES of BUTCHER-MEAT.

Date.	LONDON, Per Stone of 14 lb. Beef.	LONDON, Mutton.	LIVERPOOL, Per Stone of 14 lb. Beef.	LIVERPOOL, Mutton.	MORPETH, Per Stone of 14 lb. Beef.	MORPETH, Mutton.	EDINBURGH, Per Stone of 14 lb. Beef.	EDINBURGH, Mutton.	GLASGOW Per Stone of 14 Beef.	M[utton]
1845.										
June	6/ to 8/	6/3 to 8/	5/9 to 7/6	5/6 to 7/9	5/6 to 8/	5/6 to 8/	5/6 to 7/6	5/9 to 7/6	5/6 to 7/9	5/6
July	6/6 8/3	6/6 8/6	6/ 8/	6/ 8/	6/3 8/3	6/6 8/3	6/ 8/	5/ 8/	5/6 8/6	5/9
Aug.	6/9 8/3	6/6 8/6	6/3 8/	6/3 8/	6/3 8/	6/3 8/	6/ 7/9	5/6 7/9	5/9 8/3	5/6

PRICES of English and Scotch WOOL.

Merino	[illegible]	[illegible]/6
[illegible]	4/	18/
South Down,	17/[illegible]	22/6
Half Bred,	4[illegible]	8
Leicester Ho[gg],	[illegible]	[illegible]
Ewe and Ho[gg],	3	
Locke		
[illegible]		

SCOTCH, per 14 lb.

Leicester Hogg, . . .	15/6 to	22/
Ewe and Hogg, . . .	12/6	15/
Cheviot, white, . . .	11/6	15/
[L]aid, washed, . . .	8/6	12/
unwashed, . . .	7/6	10/
[M]oor, white, . . .	6/3	8/6
[L]aid, washed, . . .	4/3	7/
[un]washed, . . .	3/6	6/

INQUIRY INTO THE PRINCIPLES OF CONSTANT AND FLUCTUATING RENT.

THE rent of land may be held to signify either the sum naturally payable for the use of it by its cultivator to its proprietor, which varies every season, or the sum agreed to be paid in name thereof, which may be either a variable or a constant sum.

The former signification may be distinguished as *natural rent* and the latter as *covenanted rent.*

The natural rent, as also the covenanted rent of land, depend on the following facts:—1st, The quantity of produce. 2d, The price of that produce. 3d, The expense of cultivation. 4th, The profit due to the tenant.

The natural rent of any farm depends on the state of these facts in its own particular case, bearing, however, a relation more or less constant to their state throughout the country or district.*

The covenanted rent is settled by forming an hypothesis as to the probable amount of the natural rent in future years.

This hypothesis is either absolute or conditional according as the rent is to be *constant* or *fluctuating.*

A constant rent is settled by estimating the probable average state of all these facts during the currency of the agreement over the country generally, and then modifying such estimate, and adapting it to the particular case in question, by judging of their peculiar value in each case. In this way an estimate of the average natural rent of the farm in future years is formed, and may be agreed on as the constant covenanted rent.

A fluctuating rent is computed by first forming an estimate of what would be a fair constant rent as above, and then allowing such estimate to be regulated annually by the proved average value throughout the district or county of one or more of the above facts on which rent naturally depends.

This brings us to the consideration of the general question—*whether a covenanted rent ought to be constant or fluctuating.*

One of the chief arguments in favour of a constant money-rent, in opposition to every kind of fluctuating rent, is this, that however ill the former may be adapted to the times, or however widely it may differ from the natural rent of the farm, the tenant, from knowing its exact amount, can regulate his other expenditure accordingly, and the proprietor receiving such rent knows exactly what he has to spend. Now, as to the tenant, it appears to us that he is better enabled to regulate his expenditure

* The 3d and 4th facts are much the same throughout the whole *country,* though the fluctuations of rent are regulated by the state of the facts 1st and 2d in each county.

by knowing the quantity, or nearly so, of his produce, say the number of stacks of wheat, which he must lay aside as rent, than by knowing the sum of money when he is yet ignorant what proportion that sum will bear to the gross return from his farm. As regards the proprietor, again, we conceive that the virtual value of his income is fully as steady when made up of produce-rents as money-rents. This results from the fact that the staple products of the country, such as corn, butcher-meat, and wool, are the chief regulators of the value of money. Thus, if the proprietor's income be regulated by these, or even by the most important of them, he may calculate on being able always to obtain out of it pretty nearly the same quantities of the necessaries and even of the luxuries of life. But even if it were some advantage in ordinary cases for both parties to know the amount of money in place of produce which they have to give and receive, such knowledge can be of little consolation to the tenant when that money becomes double of what he would give, or to the proprietor when it is only half of what he would get, were a new bargain to be made. That such cases have often happened with farms let on fixed money-rents, during the last half century, no one in the least acquainted with the history of British agriculture will deny. There appears, therefore, to be no such advantage in a constant rent over a fluctuating one, from the mere fixedness of the one over the variableness of the other, as to make us prefer the former, if the latter can be better proportioned to the means of paying it.

The propriety of making the rent fluctuate depends evidently much on the duration of the agreement, whether as originally determined or as tacitly prolonged. The natural rent of land for a single season can be calculated with a probability of sufficient accuracy to justify the offer and acceptance of a fixed rent for it. For a period, however, such as that to which leases usually extend, it is difficult to estimate rents with an approach to accuracy even during the most undisturbed progress of legislation and of agriculture. During the extraordinary changes which this country has experienced in its agricultural as well as commercial, political, and social condition within the last half century, the calculation of rents for the period has been little else than wild conjecture, and the pecuniary condition of proprietors and tenants have in many instances been reversed.

It is obvious that excessive gain or loss to either party—both prejudicial to the advancement of agriculture—would have been avoided, or at least greatly modified, had rents been proportioned to the balance of income over expenditure, out of which balance rent is payable. The necessity of making rents fluctuate was thus most felt where leases were granted. It was, therefore, in Scot-

land, and the parts of England where this mode of tenure prevailed, that a system of rent regulated by the price of grain originated, and still exists to a considerable extent. Whether the system is likely to gain ground elsewhere, or be abandoned where it has been tried, we shall have occasion afterwards to consider. What we wish to point out here is, that the injustice of fixed rents is most generally felt in cases of farms let on lease, and this in our opinion forms the only strong argument against leases; and, therefore, *the establishment of a proper system of fluctuating rents would, besides its other advantages, be the most effectual way of extending throughout England this tenure, which, even on a less perfect system, has been of immense advantage to the agriculture of Scotland.*

We do not, however, mean to say that it would be useless to adopt such a system in cases of tenancy at will. The rents in such a case are often allowed to remain (nominally at least) unchanged for generations, so that they become as ill suited to the times as those of tenants on lease. The loss, however, from fixed money-rents at will is chiefly felt by proprietors when rents are naturally rising; for they, being felt generally, do not raise the rents of respectable tenants, as a harsh measure, however justly they are entitled to do it. On the other hand, when rents are naturally falling, tenants at will get reductions, though their rents may be nominally continued at the original amount. Tenants at will, therefore, need not suffer very heavy pecuniary loss from a fixed rent, as they have always the alternative of quitting their bargains should there be no reduction. In such circumstances, however, tenants are in an ignominious state of dependance on the generosity of their landlords, and these, on withholding the customary and necessary reduction, have a ready means of getting quit of tenants.

It thus appears that a proper system of fluctuating rents would practically be as useful in cases of tenancy at will as on lease. Such a system seems, however, in a theoretical view, to be most required on leases, and its establishment would, therefore, we think, remove the most plausible argument against that practice.

On these and other grounds, which will appear in the sequel, we conclude, in answer to our first general inquiry, *that rents ought to fluctuate.*

We come next to inquire—*By which of the four circumstances before enumerated as the foundations of rent ought its fluctuations to be regulated?*

It is clear that either the first or second of these, viz., acreable quantity of produce or price of produce, or both together, are the facts to be taken as the regulators. We fix upon these, because, among other reasons, the two other bases, viz., the expense of

cultivation, and the profit due to the tenant, though equally important with the two first in determining rent, are subject to much smaller and less sudden fluctuations, so that their influence can be more easily estimated beforehand.

Before discussing, however, whether both these facts regarding produce (viz., acreable quantity and price) should form the basis of fluctuating rents, several intermediate inquiries suggest themselves. Of these the first is—*Can we carry the principle of fluctuation so far into practice as to make the portion of the rent fluctuate which is dependant upon animal as well as that which is dependant on vegetable produce?*

The entire rent of a farm is sometimes regulated by grain, on the plea that the price of stock usually fluctuates in accordance with that of grain. A correspondence, more or less close, between the two may, no doubt, be observed over an average of several years, yet there is often, perhaps generally, such a discrepancy between their fluctuations in one or two seasons, as would render a rent calculated from the one a very false representative of that naturally payable from the other. The rent payable from stock, therefore, ought not to be regulated by grain. The regulation either from the value of stock or from the acreable value of the crops which produce the grain, is evidently the natural expedient. The former of these, for many reasons, would be extremely difficult to determine satisfactorily. One of the most obvious reasons is the universal practice of selling cattle by dead weight, which is estimated merely by the eye. Then there are so many different breeds of cattle brought into the market, and in so very different stages of ripeness, that it would be difficult to fix their average value. Still it seems possible to estimate judicially an average on the price of stock sold in the principal markets, and the average of such markets as Smithfield would form a good criterion of the price of fat stock.

But we must here apply by anticipation to stock-rents, a principle which we shall afterwards expound as a fundamental one of all fluctuating rents. By this principle we conclude that, if such rents are to fluctuate, it ought not so with the price of stock merely, but also with the quantity produced. *The average acreable value of stock-feeding crops is, therefore, the fact, rather than the average price per stone of beef, mutton, or wool,* which ought to be determined to regulate fluctuating rent payable from stock. Turnips, grass, and other stock-feeding crops being often sold by the acre, we see no impossibility in determining their acreable value in a similar way as we shall afterwards propose for the valuation of grain-crops. But as we consider the application of the above principle to the rent from grain of the most importance,

and there is, as yet, little prospect of that being effected, we need not here press the further extension of the principle. We therefore conclude *that there is no immediate prospect of making the portion of rent dependant on animal produce fluctuate on a proper principle.*

This being the case, our next inquiry is—*How ought the rent, payable from stock, the constant portion, to be proportioned to the whole rent?*

This depends on the rotation of cropping followed, as it regulates the proportion of income derived from stock; but even with a knowledge of the rotation, it is exceedingly difficult to determine this point. A perfect separation, indeed, of the two sources of rent is impossible, even by inspection of the most accurately kept accounts. This arises from a great part of the produce of one source being made to promote that of the other without a valuation being possible: and besides the difficulty of estimating accurately the value of straw, dung, &c., thus passing from one member of the rotation to another, it is still more impossible to say exactly what proportion of the expense of labour ought to be charged against each. We are inclined to think, however, that the benefits mutually given and received by the grain and stock-feeding crops, ought, under proper cultivation, to be pretty nearly balanced, and that the share of the expense which ought to be charged against each is nearly in proportion to the gross return yielded by each. On this supposition, the share of the rent determined from the average value of stock, (or fixed at a sum of money, if no such value has been judicially determined,) and that from grain, ought apparently to be in proportion to the gross return from sales of stock and of grain. This conclusion, however, must be modified by the consideration that the money obtained for stock is the return from a proportionally larger capital than that obtained from grain, and therefore its proportion for rent ought to be less. On this account, in place of taking the gross return from sales of stock, the value that would be obtained by selling the stock-feeding crops to be eaten on the premises ought to determine their portion of the rent. This mode would have the advantage of being a simpler guide than the value of the stock sold in any year, because that seldom corresponds exactly with the money received for them.

In making an offer, therefore, of a rent partly constant and partly fluctuating, for a farm intended to be cultivated on a certain rotation, an estimate would first require to be made of the average value in several previous years of its grain and stock-feeding crops. The average sum thus naturally payable out of these taken together would then fall to be computed as rent. This average might then be adopted as the supposed

average of future years, or at least it would afford data from which the future average natural rent might be formed. The sum, then, to be fixed as the constant part of the rent, representing that dependant on stock, ought to bear the same proportion to the supposed entire future average natural rent as the value of the stock-feeding crops bear to the value of the whole produce of the farm. The portion of the rent thus payable for stock must, of course, be much less where bare fallowing is practised than where the whole fallow division bears a crop.

We have now to inquire—*What is the species of grain by whose acreable quantity or price, or both, the fluctuating portion of rent is likely in future to be chiefly regulated?*

All the grain and also pulse crops (which in this case may be classed together) ought properly to enter into this calculation in the proportion in which they are intended to be grown on the farm in question; yet, as the prices of all sorts of grain fluctuate pretty much in unison, fluctuating rents are sometimes regulated by the most valuable grain alone, provided it is the chief product of the farm, since it is at the sametime the product whose price most influences that of other commodities, as also the rate of wages, &c. We do not mean to recommend this practice, yet, in justification of it, we may state that, by the average imperial prices of wheat, barley, and oats, from 1771 to 1842 inclusive, as given in "M'Culloch's Commercial Dictionary" from parliamentary returns, we find that the fluctuation in the *relative* prices of these is very small when compared with the immense fluctuations in the *absolute* price of each. Within the period above mentioned, the price of wheat fluctuated about 364 per cent., that of barley 391 per cent., and that of oats 314 per cent. The fluctuations, on the other hand, in the relative prices of these grains within the same period scarcely amounts to 100 per cent. Comparing the price of barley with that of wheat, we find that the former was always more than one-third, and only once reached two-thirds, of the latter. And comparing oats with wheat, we find that the former was always more than one-fourth, and never reached one-half, the price of the latter. The fluctuations in the relative prices of these grains, though very considerable, being thus much less important than the absolute fluctuations of each, the assumption of the species chiefly grown as the representative of the whole, in annually regulating the rent, ought to be a smaller source of error than in following the price of any, or all of them, in past years, in fixing the rent during a long series of future years. This latter course is followed in fixing a constant money-rent. It need not, therefore, appear objectionable if, for simplicity and other reasons, one species of grain should be taken as the sole basis of calculation of a fluctua-

ting rent, where such species greatly predominates as a marketable product of the farm. At all events, it cannot be out of place to inquire here what ought to be regarded as the most important grain product of the country, whether with a view to its being the sole or (on a more accurate system) the chief regulator of the fluctuating portion of the rent of good arable land. Wheat has hitherto held this place. Let us therefore examine whether there is any likelihood of a change in this respect.

A very common conclusion in the complaints of farmers of late years of a fall in the value of agricultural produce, has been the expression of the opinion that they cannot afford to grow wheat below a certain price, usually the lowest they have experienced up to that time. Nor is this merely a vague mode of talking; for such an opinion has been maintained on oath by many of the most eminent agriculturists of the country. Thus, before the parliamentary committee on agricultural distress in 1836, when prices were much the same as they were in the early part of this season, almost every witness stated that a price of wheat varying from 40s. to 65s. per quarter according to locality, rent, skill, and other circumstances, was that below which he considered he could not afford to cultivate it; and many distinctly stated that, should it fall below that price, its cultivation must be abandoned for other grains. Now, though we deprecate any measure tending, by great and sudden reduction in the price of grain, to throw part of the land now so employed into pasturage, and thus diminish the quantity of farinaceous human food, yet we cannot enter into those views which would deter us from the cultivation of wheat only. We see no reason, from the experience on the subject alluded to, or on any other ground, to expect wheat to fall in price without a somewhat proportionate fall in the prices of other grains. Now supposing our three chief kinds of grain to continue to bear the same ratio in price which they bore on an average during the period above spoken of, the return from the cultivation of them on land well suited for each would be as follows:—

Wheat.	Barley.	Oats.
63s. per quarter.	33s. per quarter.	23s. per quarter.
4 quarters per acre.	5 quarters per acre.	6 quarters per acre.
252s. per acre.	165s. per acre.	138s. per acre.

These prices may be considerably more than can be calculated on for the future, but their proportion to each other cannot be greatly altered: wheat ought always to yield the greatest return.

But it may be objected that wheat is the most exhausting

crop. We answer that it is at the same time the most restorative crop; because, while the quantity of grain, the only part not returned to the land, is less bulky from wheat than from barley and oats, in the proportion of four to five and six, its straw is more bulky in nearly the same ratio.

If the argument against wheat be put in another shape, and it be said that it incurs more expense both in work and manure than any other crop, we ask what does this objection amount to? Merely to this—That wheat (except after grass) must be preceded by a highly-manured fallow—either a bare fallow, which pays nothing, or turnips, potatoes, or other drilled crops, which often scarcely pay. Admitted. But are not fallowing and manuring necessary to keep the land clean and in proper condition, whatever sort of crop may follow—necessary for good grass, which, again, must carry good stock, that the following oat-crop may also be good—not to speak of the direct benefit which the succeeding crops may derive from the fallow-applied manure still inert in the soil? This reasoning, with some alteration of terms, applies as well to every course of cropping as to the five years course which we have had in view. If, then, such a system of cultivation is necessary for other crops as well as wheat, it is surely absurd to say that the crop which gives the greatest return for the outlay is the one which only cannot be afforded to be grown. It would be as reasonable for a fisherman who had to keep up his full establishment of men, boats, and nets, to say that he could not afford to catch the most valuable sort of fish. Thus we believe, in contra-distinction to the often-expressed opinion of the farmers themselves, that wheat will continue to bear as high a proportion in price to other grains as it bears at present, however much the cultivation of all may increase or diminish. In truth, we rather expect to find the proportion of wheat becoming every year greater on account of its being sown more generally after turnips, and of the extended tillage of the old grass-land of England, most of which is admirably adapted for wheat.

On these grounds, then, we are of opinion that wheat is likely to continue to form the chief basis for calculating the fluctuating grain-rents of good arable farms.

We have now arrived at this point of our inquiry—*Whether ought the fluctuating or grain rent be regulated by the average price alone, or by the average both of price and acreable quantity of grain produced throughout the district or county?*

We have already anticipated, so far, the answer to this question, by stating that, in the case of the share of rent payable from stock, if the rent is to fluctuate, it ought to fluctuate both with the average price and the quantity of stock, or of stock-

feeding crops. Price alone, however, has hitherto been attended to in regulating grain-rents. This we consider to be a glaring defect in the system now followed, as applied to the present, and more especially to what we hope will be the future state of our grain markets. We consider such a system in many instances to be unfair to the proprietor and in others to the tenant. It is unfair to the proprietor when the crop of the county, and therefore, presumably, that of his own property, exceeds the average quantity of many years' crops in a greater degree than its price falls below the average, and for the tenant, when the crop falls under an average quantity to a greater degree than its price rises above the average. But, suppose the fluctuations in price to be exactly the reverse of the fluctuations in quantity, the present method is far from being a proper one for adjusting rent; because, were the price to fall in the same proportion as the acreable produce increased, the tenant ought still to have the same *income* from his farm, which being obtained at a smaller *outlay*, he would have a greater balance to pay rent from a large cheap crop than from a small dear one. Hence the present system of grain-rents is particularly unfavourable for the landlord when the crop is abundant and cheap, and equally so for the tenant when scanty and dear. Its only proper and justifiable tendency seems to be, to give the proprietor a share in the benefit from a rise in prices, when the rise is not produced by a deficiency of crop, and to protect the tenant against the entire loss from an unlooked-for reduction of price through an inundation of foreign corn. This latter casualty the tenant is guarded against by protective duties, and will, we hope, continue to be so till our now rapidly improving agriculture shall have put him in a state to require protection no longer.

The extraordinary fluctuations in the price of grain in this country during the continental war were not caused entirely, or even chiefly, by corresponding variations in the quantity raised. The immense rise in price, on some occasions, was caused partly by bad harvests, but still more by the fear of their recurrence, whilst foreign supplies were almost entirely excluded, and by speculators being thus induced to diminish the supply for immediate consumption by storing grain. The sudden and great fall in price on more recent occasions was caused by the abundant home supplies being rendered still more abundant by a sudden opening up of foreign traffic. The prices of grain, under both these circumstances, and similar circumstances have happened in earlier periods of our history, varied much more than the quantity produced. The rent naturally payable, therefore, often depended more on the price than on the quantity, so that

the regulation of fluctuating rents by the average price was the natural means to resort to. This system was adopted, and, no doubt, saved many a farmer from ruin, after the conclusion of the war, and where adopted, then, secured to landlords a fair share of the rise in the markets occasioned by the war. Having thus far supplied the necessity which called it into existence, the present system of grain-rents is gradually becoming less popular—people are beginning to think that the most natural state of the relation between landlord and tenant is *to pay most for the use of land only when it produces the most abundant crops.* Another argument against the present system of fluctuating rents is, that the fiars prices are a very imperfect average of the true prices obtained for the entire grain sold within the county. This error we shall allude to when we come to speak of the mode of fixing the average of the prices.

Where the principle of this system of payment is still adhered to, various modifications have been introduced in its mode of action. Sometimes a maximum and minimum sum are fixed, between which only the regulating price shall fluctuate. In other cases the average price of the article, for several years, in place of that year only for which the rent is payable, is taken as the basis of calculation. And in some cases both expedients are resorted to. They are all, however, merely empirical cures for the evil, and founded on no sound principle. We, therefore, come to this conclusion—That unless both the first and second foundations of rent above laid down, that is, unless the county average of the acreable quantity, as well as that of the price of the regulating grain, be taken as an element in the calculation of fluctuating rents, these can never be properly adjusted. Indeed we conceive that, if one of the fundamental facts only is to be acted on, it ought in future to be rather the acreable quantity than the price of grain. We found this opinion on the consideration that there is a tendency more and more towards a free trade in corn, and that the more our markets are thrown open to the competition of agriculturists, from all climes and counteracting states of weather, the more steady should be the state of the markets; while we cannot suppose that the quantity we ourselves produce will by that competition be rendered more constant. We would by no means, however, be understood to propose that the quantity of produce should be taken as the sole regulator of fluctuating rents, but merely to predict that it will at some future period become a more important element than price in determining rent.

The adjustment we propose is the number of bushels of grain forming the grain-rent convertible into money by the judicial

average price that should bear a constant proportion to the number of bushels per acre of the same sort of grain grown in the same year throughout the county.

Such an adjustment of rents would have afforded an inexpressible consolation to farmers under the sad prospect forced upon them by the destructive rains in the month of July last. Then every farmer had the prospect of his income from the crop on the ground being much reduced; but tenants bound to pay in rent the price of fixed quantities of grain then felt the additional grievance of having their rents increased nearly in proportion to the destruction of their crops. They, we conceive, would have sufficient cause to deplore such a destruction, even were their rents slightly diminished on account of it. By the adjustment we have proposed, this diminution could only be slight; for the price of grain must always be increased by a failure of the crops, though by importation from abroad the increase may be prevented, being proportionate to the deficiency in the quantity produced. Thus landlords can have no ground of complaint, since their share of the calamity would be small.

After a succession of fine seasons, such as we have experienced of late, we are apt to forget or depreciate the influence of the weather on the crop, and, in the pride of science, to think that we can command a large and steadily increasing produce independently of the weather. Such rains as that under which the crops suffered this summer painfully but powerfully remind us of our dependance on the elements, and the result of last harvest will shew the deficiency in produce bad weather can effect, even in the improved condition of our agriculture.

The want of statistical information on the variation in the produce in different seasons is much to be regretted. In the absence of exact intelligence on this subject, we may allude to an estimate which appeared in one of the public prints on 11th August last, of the then prospects of the amount of the wheat crop of 1845 as compared with that of 1844. By this statement crop 1844 was estimated at twenty-four millions of quarters, or six millions beyond an average, and crop 1845 was then estimated at fifteen millions of quarters, or about three millions below an average crop. Now, as this gives a difference of fully a-third over the whole country, the difference in particular districts must be supposed to be much greater. This deficiency was expected, on the publication of the statement referred to, to be caused by failure in the southern and eastern counties of England.* In any case, however, if there is a difference of one-third betwixt the quantity produced over the whole country in one season, as compared with

* The realization of the crop of those counties fortunately does not support the expectation here referred to.—EDITOR.

that in another, we may safely take the difference in particular counties at one-half. Nor was the expected deficiency alleged to arise from a diminution in the extent of land under wheat. On the contrary, we have reason to believe that the present crop supports the supposition advanced above, that the extent of wheat culture is annually on the increase. The deficiency therefore being an acreable deficiency, that of itself should be a sufficient argument for the regulation of rents by the acreable quantity, as well as by the price of grain.

Without, however, resting the case on a remarkable instance of either deficiency or excess in crops, there are other arguments in favour of the system we propose, founded on the relation between landlord and tenant in particular, and on the duties which both owe to the country in general.

The arrangement proposed would give the proprietor and tenant their just shares of profit and loss from the general improvement of agriculture, without influencing the gain or loss due to the tenant for his peculiarly good or bad management.

When his land is let on a constant money-rent, the proprietor's only benefit from the increased produce of the country, on account of general improvements in agriculture, depends on the frequent disproportionate increase in the value of money. When, on the other hand, it is let on the present mode of grain-rent, an increased produce by such means is rather a loss than a gain to him, by its reducing the price of grain more than that of other commodities, and consequently lowering his rental more than it raises the value of money. We see no reason why the proprietor should not share with his tenant in the variation of the productiveness of the soil, whether occasioned by the weather or by the application of science, as well as in the variation of prices.

By this mode of paying rent, landlords would also derive the additional advantage of choosing skilful tenants, who, by increasing the produce of their farms would raise the average produce of the district, and consequently establish the means by which their rents would be increased.

An inestimable benefit would result to the community from the adoption of this practice, by giving proprietors a more immediate pecuniary interest in increasing the produce of their estates and of the country around them, as also by its thus creating a strong inducement for them to reside on their estates.

It may be objected that, by reducing rent as the average produce diminishes, there would a premium on bad farming be established. Such would be the case were the rent merely to vary with the produce of the farm for which it is paid; but when it is mainly dependant on the produce over a large district, the objection loses [illegible] the influence of a scanty crop of one

farm in reducing the average of the district would be so small, and the loss from it to the farmer so great, that the increasing productiveness of his farm would be as much an object to him under this as any other system of payment. It would thus present no temptation to relax his energies.

One of the strongest arguments in favour of *this particular system* of fluctuating rents is one which we have already brought forward in support of fluctuating rents in general. It is this—that by proportioning their income to the state of the country, such a mode of rents would deprive proprietors of the most plausible argument against granting leases, and would, therefore, induce the practice with its numerous good consequences to be greatly extended.

On these and other grounds, which it is unnecessary to state, we conclude that *fluctuating rents ought to be regulated by the average both of price and acreable produce of grain throughout the county.*

We must now inquire how the bases of such a system are to be established. And first, *How can the annual average acreable produce of grain in each county be ascertained?*

The difficulty of determining this statistical fact is the only considerable obstacle to the reduction of this theory of grain-rents to practice ; yet, though we cannot suggest any perfectly unobjectionable means for effecting the object, we are confident that, were the country generally as much convinced as we are of the many important uses (besides the regulation of rent) to which this information might be applied, means would soon be used for obtaining it. Sufficiently accurate data might perhaps be obtained by examining, on oath, a number of farmers from every parish in each county, on the average number of bushels of grain per acre grown on their farms in the previous season, in the same way as they are examined on the prices for which their grain is sold. Farmers would have no more difficulty in keeping an account of the quantity than of the price, and there would be as good a check on their statements of the quantity obtained as of the price for which it was sold. The maintenance and raising of their characters as agriculturists would, without any other check, be sufficient to prevent farmers from understating the acreable amount of their crops. It might, indeed, be necessary to have inspectors, moreover, for the different districts, to see that the extent of land under each kind of crop and the yield from land were correctly reported. We might enter more into detail as to the means of working out this inquiry, and suggest other methods of investigation which have occurred to us, but such details are unnecessary on this first mooting of the subject.

We must, however, notice an objection which will very readily be urged against any such inquiry. It will be considered at first as of too inquisitorial a nature, and the disclosure of the rate of produce on individual farms will be said to be taken advantage of by landlords in reletting them, to the prejudice of the tenants in possession. Such a disclosure might be avoided before the public. At any rate, each witness would only be called on to disclose, at long intervals, the return from his farm, perhaps not more than twice or thrice during his lease. But even if a more ample disclosure were required, tenants would have much less ground of complaint against this than against the disclosure of their whole means and substance for the poor's-rate assessment, or that exacted of every class but themselves in respect of the income-tax act, and of which they complain of not being allowed to do in the same way as others.

We come to inquire in the last place, *How ought the average of the price of grain in counties to be determined?*

The county average (or fiars) prices of grain, as at present fixed in Scotland, give only a rude approximation to the real average of the entire sales in the county during the season. This arises from the fact that about one-half of the grain remains unsold at the date (February or March) when these averages are taken. Should any unforeseen change take place thereafter in the prospects of the next crop, (just as has happened this season,) it is evident that the price of the grain sold thereafter may be very different from that sold previously. Even on that ground alone, the present time of taking the average is not the correct one. But, further, it often happens that farmers sell their lightest and least valuable grain in the beginning of the season. Indeed we find, even in districts where rents are not regulated by the value of grain, and where, consequently, no desire can exist to depreciate it, that the grain thrashed in the spring and summer months is usually of better quality (apart from its improved condition by being kept) than that thrashed earlier. This is often the case when there is an intention of storing, as it is only wheat of good quality that is ever kept to another season. And it is notorious that there is usually a very considerable rise in the price of wheat as the season advances, and after the fiars are struck. The farmer, however, argues that he often loses much more in the bulk of his grain than he gains in price by keeping it in the stack after the date at which the fiars are struck. This is, no doubt, true, but such loss is in a great measure the farmer's own fault, as the grain ought to be thrashed out before a great destruction has taken place in the stack, and kept in the granary if not sold and where it is necessary, for the sake of im-

proving its condition, to keep it in straw until a late period, the stacks ought to be protected against vermin by *being* placed on *stathels* or otherwise. Be this, however, as it may, it is the real average of the entire sales of the particular crop which is *professedly* fixed by the fiars, and by which, besides rents, ministers' stipends, for fixing which the inquiry was originally instituted, are intended to be regulated. Still, though these payments ought to be regarded as improperly fixed at present, and a more correct result should be obtained by taking the average prices of a crop at a season when it should be all sold, there would be room for complaint were the true average taken to regulate existing agreements entered into on the faith of the present imperfect system being continued. It would, therefore, be desirable, in making such a change, that during the first twenty-five years, or such time as most of the current leases might be expected to endure, two averages should be taken, one in the spring, as at present, of the sales up to that period, and another in the autumn or winter following of the remainder of the sales, which, combined with the former, would give the complete average. Or the evidence on both periods of sales might be taken at the same time and kept separate. Rents of current leases could thus be regulated by the partial average as at present, and those of future agreements by the complete average.

We may here remark that we have heard it suggested that some more natural and rational division ought to be made of the land of the country, for ascertaining averages both of produce and price, than what presently exists in the division of counties. These divisions ought each, perhaps, to be subdivided into three agricultural districts, according to altitude or otherwise. Such, no doubt, would be a great step in agricultural statistics, could it be accomplished. Both the quantity and value of produce in this country, however, are so little regulated in regard to the locality of the land, as respects its latitude, or altitude above the sea, depending much more on the nature of the soil, its distance from extraneous manures, good markets, &c., that no general rule could be established, we fear, which would lay down such divisions in a satisfactory manner. At present, a first, second, and, in some cases, a third rate of fiars price of grain is fixed for most counties in Scotland, without, however, any distinction being made of the land on which such grain is grown. This does not appear to us to be founded on any sound principle; for it seems a contradiction in terms to speak of two or three different averages of the same thing, viz., an undivided collection of sales of grain. However many rates of price may be fixed, they cannot meet the case of each individual farm, and it seems quite as easy, indeed

easier, for the proprietor or offerer for a farm to calculate the superiority or inferiority of the crops of a farm, relatively to a general average of what is quite definite, though extensive, (viz., the price of the entire grain of each county,) as in relation to an average over a limited range, the limits of which are in no way defined. It being impossible to divide the land in the way we have spoken of, the limits of the different qualities of grain referred to could only be defined by fixing the range of weights per bushel of each lot, whether of first, second, or third quality; yet, though the weight per bushel is the only general test of the value of grain that can be applied, it is by no means a perfect criterion of its quality, so that we are of opinion that only one average of the prices obtained for the total quantity of each of the different kinds of grain sold can be determined on a just principle.

We shall now sum up this inquiry by recapitulating the leading conclusions at which we have arrived in its course.

After narrating the foundations of rent in all the acceptations of the term, whether of natural or covenanted, constant or fluctuating, we inquired whether a constant or fluctuating rent were preferable, and concluded in favour of the latter. We then shewed that, though the whole rent ought, on strict principle, to fluctuate, we must in the present state of things allow that part of it dependant on stock to be fixed by a constant sum. We next remarked that the proportion between stock-rent and grain-rent is naturally regulated by the rotation of cropping, and pointed out how the fixing of a proper constant sum for a stock-rent ought to be determined. After this we considered what kind of grain was likely in future to be the chief regulator of fluctuating grain-rents, and concluded that wheat, as hitherto, was likely to hold the pre-eminence. Our next conclusion, and the most important in the whole inquiry, was, that the average acreable produce, as well as the average price of the regulating grains in each county, ought to enter into the calculation of grain-rents. We then suggested the means of estimating this acreable produce, and pointed out what we conceive to be a great imperfection in the present method of determining the fiars or average prices of grain in the counties of Scotland, owing to the period at which these averages are taken; and we proposed a way of modifying this imperfection without injury to existing interests. And, finally, we alluded and objected to the present practice of fixing two or three different average prices of grain, more especially without dividing the grain sold into two or three corresponding lots of determinate weights per bushel.

A SKETCH OF GERMAN AND DUTCH HUSBANDRY.

Germany.—After leaving Belgium, and taking a hurried view of the magnificent scenery of the Rhine, I directed my steps to the north of Germany; and as most of the country I passed through was a mere barren sandy waste, possessing little attraction in its scenery to a tourist, and much less inviting in its agriculture to a farmer, I was not so particular in my inquiries as in Belgium, and, therefore, have little of importance to mention on that subject. There are, however, certain oases in this extensive waste which mark themselves not only by the luxuriance of the crops, but by the cheerfulness of the scenery and the numerous smiling villages. Among these the principal are parts of the dutchy of the Lower Rhine, the Saale and Helme valleys, a portion of Mecklenburg, and the delta of the Vistula. The culture practised in these districts varies with the locality and the demands of the place. The soil in the valley of the Saale is of fine quality, and well adapted to the growth of barley, great quantities of which are raised, and the grain is unequalled in quality. A plant which is extensively cultivated here, also, is the beet, for the sugar manufactories established in Magdeburg. Great care is bestowed on the cultivation of this crop—in weeding and hoeing it;—and a considerable portion of the rural population depend for their livelihood on the employment they get in the cultivation of the beet. The valley of the Helme is watered by a stream of that name, and is passed through in going from Cassel to Halle. This road is one of the most picturesque in the north of Germany; and a person coming from the sandy flat about Berlin cannot fail to enjoy the scenery, which assumes a new feature at every turn of the winding hilly road. In the fine parts of Mecklenburg wheat is grown in considerable quantities for exportation to Britain. The most of the wheat grown here is shipped from Stettin. It is rich in minerals. Silver to the amount of nearly L.4,000 is yearly obtained here, while iron and copper are also found. Brown coal is worked and burnt in all this neighbourhood for fuel. It is formed, by means of water, into shapes, in which state it is burnt. But it is the soil which demands our attention. It is of the finest quality, and so rich as to entitle the valley to the name of the *Golden Valley*. It produces very heavy crops of wheat, rye, grass, and oats, which are the principal plants cultivated. The poppy is one of the secondary class of farm produce here. The rotation followed here is, fallow, wheat or rye, grass, oats; and the strength of horses kept on the farm corresponds with that of farms managed in the same

way in this country. The farms are small and the fields uninclosed. But by far the most fertile part of the north of Germany is the delta of the Vistula, which extends for a considerable distance from the banks of the river. It is, however, inconsiderable when compared with the extensive wastes which skirt it. It consists entirely of alluvial deposit derived from the overflowings and former courses of the river. The soil is a stiff retentive clay, and would be much benefited by the introduction of a good system of surface drainage. The farms are small, and are either occupied by proprietors, or, as is more frequently the case, let to tenants, who club together in villages, which are composed often of nothing but their houses and offices. The great luxuriance of the crops raised, with no display of skill, is a sufficient test of the fertility of this district. But these rich spots form but an inconsiderable portion of the north of Germany, a very few particulars of the agriculture of which I will now mention.

Agriculture is improving rapidly in some districts of this part of Germany, particularly in the neighbourhood of those towns which have much trade with England in corn, and the consequence is that land is now rising in value. I know of instances where, within the last twenty years, the value of land has been increased to more than double. But there is still great room for improvement. The land is farmed, for the most part, by proprietors whose properties vary from three to thousands of acres, according to the districts in which they are situated. In some localities the farms are all small, in which case the farm buildings are all collected in villages. Sometimes as many as seven or eight compose a village. Farms of this description are to be found near the towns, which they supply with milk. The farmhouse and offices are generally connected and under the same roof. This building is oblong, with roofs at the gables as well as at the sides. One end is devoted to the dwelling-house, before which is a patch of ground very neatly laid out as a kitchen and flower garden. The kitchen fire is often on the outside of the wall, which divides the farmer's rooms from the rest of the building, which is tenanted by the cows on the one side, the horses on the other, and the carts and implements are placed between them; while at the end are large folding doors, which close in all the farmer's movable property. But the generality of the farms are large, and possessed and farmed by a most respectable class of men, many of whom are men of education; and they are all distinguished for their great kindness and hospitality. The house on such farms is quite separate from the offices, and is surrounded generally by an extensive garden. The offices are in the form of a square, inclosing an area in the middle for the accumulation of the manure. They consist of byre, stable, sheep-

shed, corn-shed—for all the corn is kept in houses instead of stacks—and servants' houses. The buildings are often erected according to the most approved principles for convenience and comfort to the animals. Having mentioned a sheep-shed, I think it necessary to explain its use, as there are no similar erections in Scotland. The sheep are always kept in in winter, when they get potatoes and hay, and the greater part of summer, when they get clover. Some of these sheds are very large, capable of containing 1500 sheep. There is a walk made along the side of one of the walls, and the area between it and the other wall is divided into compartments, by means of railings, designed to hold a certain number of sheep; each of these divisions is furnished with a rack for the hay and clover, and troughs for ground food; and a small gate leads from the side walk to each division, so that the keeper can supply the different lots with food, and inspect them without much trouble or disturbance to the whole flock.

The principal grain cultivated in the north of Germany is rye, of which there is said to be eight times more grown than of wheat, for which the soil, being in many places bare sand, is not at all adapted. The black rye bread is the principal food used by all the poorer classes, and in Westphalia it is to be found on the tables of rich and poor, and there goes under the name of *pumpernickel*, which was given to it by the French, on their march to Russia. Potatoes are now largely cultivated, and flax and buck-wheat form in some cases a part of their produce. The triennial rotation is still prevalent all over Germany, which shews at once the backward state of agriculture. Fallow, or potatoes, or flax, is the first year of the rotation, (turnips are never raised but in gardens,) then wheat or rye, and lastly rye or oats. The oats grown are in general very bad in quality. This is the prevailing system; but we shall immediately advert to a course adopted where agriculture has undergone every improvement, which is producing rapid changes on the face of the country; for where, in Pomerania, the most barren spot in Europe, the road from Stettin to Danzig lay through a heathy waste a few years ago, it is now, retaining its former line, skirted by healthy crops of rye, potatoes, and some fresh fields of grass.

The following sketch of the management of a farm ten miles from Danzig will give one some idea of the system carried on among the most intelligent farmers there. This property consists of 1400 imperial acres, which is all arable but a very small part. To work it 36 horses and 60 oxen are kept throughout the year, 4 horses or 4 oxen being used for one plough. The horses are small, and in general not in first-rate condition. For this

property, including land, houses, animals, and implements, the gentleman paid £8,400, which may be cosidered as a fair estimate of the value of land and agricultural property in that district. His rotation is—1st, fallow, 2d, wheat or rye, 3d, grass for two years, 5th, fallow, potatoes or pease, 6th, wheat or rye, 7th, oats. Rye is the principal produce, but he also grows a considerable quantity of wheat. The potatoes are grown expressly for his family, servants, and as winter food for his animals. He only kept as many cows as were necessary to supply his own family and the hinds with milk. One man is kept for each team of horses or oxen, which is driven when in the plough by a boy. The ploughmen receive 6d. a-day, out of which they must clothe and feed themselves, a house being provided for them. The women get 3½d. a-day, and girls 2¼d., out of which they must provide themselves with the necessaries of life. These are the highest wages given to farm-labourers in that locality, and, no doubt, will startle one who has never considered the question before. The first question that will be asked is, How can they live on such a pittance? which is best answered by mentioning their dietary. In the morning the labourer gets rye-bread and milk; in the forenoon, potatoes with such *kitchen* to them as they are enabled to obtain from one pig they *sometimes* fatten during the year; in the evening, either bread and milk or simply rye-meal brose. The German labourers are very slow at work, and do much less than is commonly expected from the same class in Scotland.

With such low wages, and with such a low value of land, it will be readily seen that they are enabled to sell their produce for very little, and at no loss. The gentleman to whom the property above described belongs, was selling his wheat when I saw him at 31s. a quarter; and I understand that the farmers can afford to sell their wheat and carry it to the ships for 30s., without a loss, while they consider themselves amply remunerated for every expense attendant on the raising of a crop of wheat at 35s. a quarter. The merchants in Danzig generally allow 6s. 6d. a quarter, as a fair average for freight, insurance, and other incidental expenses from that port to England. Therefore wheat grown in the north of Germany can be sold in an English market at 41s. 6d. the quarter, with a sufficient profit to the German cultivator.

I will mention here a visit I paid to a potato distillery near Danzig, where potato whisky, or, as it is called in this part of Germany, brandtwein, that is, brandy, is made. The distiller possesses a farm also of 600 acres, of which 300 acres are always in potatoes and the other half in rye. He dungs the land at every crop of potatoes. He has 40 horses, besides oxen, em-

ployed on his farm, and 120 cattle tied up to fatten. The number he will fatten depends on the condition in which he ties them up. He shewed us one, nothing but skin and bone, which would take six months to fatten. The whole of the animals, horses, cows, sheep, pigs, were fed on the refuse from the distillery as part of their food, and the fattening animals got nothing else. His method of making manure is deserving of attention. He first puts down the rough dung, on this a layer of good earth, and then a layer of marl, and the whole is steeped in the urine from the stables and byres. Immense quantities of manure are thus made. The potatoes are never hand-hoed, but are planted so far apart as to admit of a plough passing between them longitudinally and transversely. Wages are low here. Men get their meat and from £4 to £5 in money in the year. The whole of the potatoes grown on his farm are employed in the distillery. They are first boiled and then crushed, and malt added. It is put out after this upon a level, and mixed with ice to cool it more rapidly, and the mixture sinks down to a cellar, where it ferments, after which the operation of distillation is performed. 150 bushels of potatoes are used daily, and 180 gallons of whisky made at this season, but in winter considerably more. He obtains 10,000 quarts of refuse from this distillery daily, and each feeding cow gets from 100 to 120 quarts. The produce of 10,000 quarts must be meant for the *present* season, as he could not feed so many animals as he mentioned if 10,000 were the yearly average. The whisky sells for about 3d. a bottle.

Holland.—Having completed my tour in Germany, I sailed down the Rhine from Dusseldorf, and set foot first on Dutch land at Arnheim. Holland as a nation is quite unique, and ought to be visited by every Scotchman who wishes to see a country in every respect the reverse of his own. When viewed from the sea, the coast of Holland is marked by a dark unwaved line in the horizon, and the villages, seen to their very foundations, rise in bold relief on the clear blue sky. The tourists who annually traverse countries and continents are induced to visit most places, either from their possessing natural beauties and attractions, from their fame in history, or from containing within them objects hallowed by antiquity, celebrated works of art, or abundant sources of amusement and pleasure; but Holland, besides holding out all these inducements to a traveller, (excepting what is natural, of which there is no true exemplification to be found in it; for even what was originally natural has been made to assume an artificial appearance,) possesses much that is far more

attractive to him, as he can nowhere meet with the same or similar objects of attraction. It invites the mere novelty-seeker; for there he will find the most of the land in the kingdom reclaimed from water; he will be placed in the awkward position of knowing that he is there entirely at the mercy of the waves, which rage without the barriers thrown up to oppose their progress, and make the most vigorous efforts to regain their former dominion. He will see everything different from what he is accustomed to find anywhere else—houses in the busiest and most smoky towns as clean as if the painter's brush had just been removed from them for the first time; streets unspotted by mud; trees painted in the gaudiest colours, and clipped into the most fantastic forms; every town, every province intersected by canals, many of which are below the level of the sea, with which they are in connexion; and a people delighting to spend their pleasure moments over stagnant and fermenting ditches, from which rise the most noxious vapours and the most offensive effluvia. It invites the philosopher; for there he can see his laboratory experiments in hydraulics brought to a practical and useful end, and carried on on the grandest scale ever projected by man; he can see also the existence of a kingdom dependant constantly on the minute calculations of men of science. It invites the historian; for there he will tread on many a spot hallowed by individual acts of self-devotion to the cause of patriotism. He will be reminded in many a city of former displays of unrivalled national valour, and of the most dreadful sacrifices made in defence of liberty and country, preferring death, and even the destruction of their country, to the yoke of an invader. It invites the artist, to judge, criticise, and admire the works of its children, many of whom are excelled by none in the world. It invites the agriculturist, and with pride bids him walk over its once submerged fields, now covered with the richest luxuriance, visit its once moving sand-hills, which it has fixed in their present position, and turned to profitable account by an attentive observance of the laws of nature; examine its system of draining, in which it has rendered one element subservient to its will in overcoming another and more dangerous; bids him enter its dairies, and follow the example there shewn him of cleanliness and comfort to the animals under his care.

The first place in Holland I went to visit connected with agriculture was the agricultural colonies at Fredericksoord and Willemsoord. They were established when, after two years of great scarcity, a large proportion of the population were reduced to absolute destitution, and depended entirely for their subsistence on the charities of their more fortunate countrymen. So

prevalent did the practice of begging become, that it was found necessary to do something to relieve those unfortunate men who were willing but unable to get work. A society was, therefore, formed by a few benevolent individuals, the object of which was to give employment to men in this deplorable condition. In carrying out their purpose, they conferred not only an immediate and lasting benefit on the individuals in question, but effected great national advantages, first by stemming the spread of vice, which would have been the natural consequence of such destitution, and, in the second place, by increasing the national resources in converting to arable land a waste on which even a sprig of heather was scarcely to be met with. Such was the origin of these colonies twenty-four years ago. And no one can travel the road along which they are situated without noticing the great change that has been effected on the face of the country by their establishment; and the change is doubly observed when we pass from the unimproved waste to the neat cottages which line the road. From a wild barren country we enter at once a little oasis which bears every mark of prosperity; neat cottages, betraying the Dutchman's taste in their clean appearance, crops as luxuriant as if nurtured by a better soil, and gardens stocked with useful vegetables and adorned with a variety of flowers. Each house is placed at the road side, in the middle of the plat belonging to it, and directly opposite to another on the other side of the road. The buildings are all in one, the part allotted to the cow and pig being built of wood and the cottage of brick. In the cottage are two rooms, one of them is large, and answers the purpose of kitchen, dining-room, and bed-room for some of the family, the other is small, and contains only a bed at one end, and at the other a closet, which answers the purpose of a milk-house. Great attention is paid to the dung, which is put up into neat heaps at the back of the house, consisting of alternate layers of turf and manure from the byre, and watered every now and then by the liquids previously collected from all the houses, in a cask sunk in the ground. In Willemsoord, which is the smaller of the two colonies, there are 176 such houses, all tenanted by paupers but six, whose occupiers pay rent for their farms. The quantity of land attached to each house is about seven acres imperial. The colonists are all supplied with implements on entering on their plat, besides a cow and pig. The food of the colonists is, for the most part, potatoes and rye-bread, with milk, little or no flesh being used. The small farmers pay £3 : 15s. a-year for their plat; but the whole produce of the colonists' land is taken to the general magazine. There is a regular creditor and debtor account kept with them from their first entering the colony. Everything they

receive on entering is marked down against them, and whenever they are enabled to pay off their debts from economy of living, they are allowed to rent their plats. Some have succeeded in this; but the instances are rare. The scheme is not to be looked at in the light of a speculation; for, as such, it was never intended: but it has sufficiently succeeded in the object for which it was designed, viz., the relieving of the destitute, besides the consequent advantages referred to before. Attached to these colonies are others of a penal character, to which unruly members are sent and subjected to more rigorous laws than are necessary in the free colonies. The wages and rations allotted to them are as follows:—Suppose a family of eight individuals, husband, wife, and six children, three of whom, with their father, work, the other three go to school, while the mother remains at home. The sums set down for wages here are only imaginary, being somewhat higher than they are generally allowed.

			Per Week.
Man at 10d. a-day,			L.0 5 0
Son at 10d. a-day, and other two at 2s. 2d. each per week,			0 9 2
Wages earned for whole family per week,			L.0 14 2
From which is deducted—			
Winkel geld,	L.0 5 4	per week.	
Bread, potatoes, and clothing for eight,	0 8 0		
	L.0 13 4		0 13 4
Which is put down to their credit for future emergencies,			L.0 0 10

By winkel geld is meant money for buying little necessaries, such as coffee, tobacco, &c., the allowance for each person of it is 8d. a-week. The allowance for bread, potatoes, and clothing is 1s. per week for each person. The only crops grown by the colonists are rye, potatoes, and grass. The farmers grow what they choose. There are several overseers who superintend the work done in the colonies. Attached to them are schools for the gratuitous education of the children, and also workshops in which they are taught some useful trade. I passed one of these shops in which there were from thirty to forty looms worked by the children, and adjoining it was another room, where some were engaged in spinning, mending shoes, and other occupations. I was attracted to the place by the busy clatter of the shuttles and sounds of music which proceeded from it; and, on coming up to it, found them engaged at their respective occupations, cheering on one another in their work by a song in which they all joined. What health, what happiness shone in these pauper children's faces! Their looks were a sufficient proof of the benefits derived from such an institution.

Is the establishment of such societies impracticable in our

own country? Are there not thousands of unimproved acres, that have been condemned as useless, many of which exceed in fertility the waste in which the Dutch colonies are situated? Are there not hundreds of unemployed hands who crowd our poors houses and pauper rolls, who frequent our roads and streets as medicants, who haunt our lanes as degraded miscreants, advancing their poverty as a palliation of their vices and crimes? Is there not money raised to relieve the destitute? And are there not many benevolent individuals who, by the gratuitous bestowment of their charity, encourage idleness and foster vice? In Britain, truly, we have the elements for such a society; but we want some master spirit to bring them together and put them into operation. It is a subject that cannot be too strongly pressed upon proprietors of land as the best way of improving the waste portions of their properties, and of reducing, at the same time, the burdens with which their cultivated lands are so heavily taxed.

I shall now detail a short trip I had through North Holland, in which I visited some of the farms where the celebrated Dutch cheeses are made. The route I took is one that every person wishing to obtain in a short time a knowledge of the characteristics of Holland and the Dutch ought to take. But I will put him on his guard against the extortionary habits of the people, which will be very apt to throw him into bad humour, and thus mar the whole pleasures of his journey. When he reaches some of the towns in North Holland, he will be called upon to pay most exorbitant charges for the simplest meals and dishes, unless he should take the precaution of bargaining with the innkeeper before hand. The poorer classes in Holland will not perform the slightest favour for a stranger without expectation of some recompense. And people there will expect and take a gratuity from a visitor, which a person of the same class in Britain would spurn at as a breach of hospitality. I allude to the small farmers.

By means of ferry and trekschuiten, we arrived at Buiksloot from Amsterdam. The first part of our road lay along the banks of a canal, indeed on one of the dykes, for the roads here are often made on the dykes, so that we have a good view of the extended flat which is stretched out on both sides of the canal, with the surface all intersected by ditches, but covered with a luxuriant sward of grass, excepting where it is replaced by rushes in the wettest spots. The farms in the first district we passed through are all tenanted by farmers who are allowed to remain on the ground as long as they are regular in the payment of their rents. The men who occupy them are, in general, possessed of little capital. The farms are from seventy-five to

eighty acres in extent. The price per acre is 33s. 4d. The number of cows kept varies from thirty to thirty-six, according to the soil and the management. The one half of the farm is kept for pasture and the other for hay. They are very careful of the dung about the place, and put it on when thoroughly rotted. This, with the submerging the fields get in winter, is all the return made for the good it does the farmers. The cows are beautiful, and kept in the finest order; indeed many farmers seeing them would be apt to consider them too fat to give milk. They are black and white, and many of them are marked like the sheeted breed of cattle, the colours being black and white instead of brown and white, as in the latter. They are very small in the bone, have small heads, thin necks, and capacious carcases, with large udders. This is the description of cattle found all over Holland. The interior of the farm-places shew all the neatness and cleanness generally spoken of by writers. When the door was opened for me to enter, I felt more inclined to undergo the process of purification than the worthy doctor did before entering the sacred temple of Juggernaut. We went through the byre first, which is unfrequented at the present season by its accustomed inmates. It is divided into stalls for two cows each, every piece of wood about which bore evident marks of hard scrubbing. Many a dining-table it not so clean as was the floor of this cow-house. In all the stalls there is a layer of clean shells as level as the newly gravelled walk which leads to some lady's bower. At the top of the stalls a trough built of bricks runs along the length of the byre, from which the cows drink water; and over each stall, attached to a beam in the ceiling, is a ring to which the cows' tails are tied up when they are in the house. A door opens from the byre to the milk-house where the cheese is made. This shews the same cleanness as the cow-house. Thence we went into the cheese-salting room, where they are kept in pickle or salt for ten days. We were led through a door-way which opened from the byre to the winter kitchen. Three sides of this room were papered, and the fourth, as well as the fire-place, was adorned with square pieces of porcelain of different colours. Instead of having a grate, a large metal plate is placed on the hearthstone, and extends for a good way into the room, under it is placed some live coal, and in the winter nights, when the waves of Zuyder Zee roar without, the family sit round the blazing faggot with their feet upon this heated plate, and talk over the events of the day. The walls of the room are hung with Roman Catholic engravings, while the floor is all matted. We were shewn into other two rooms, the one a bed-room and ordinary parlour, the other a parlour, used only on particular occasions. These were also matted on the

floor, excepting the centre, where the well-cleaned slabs of marble were exposed to view. The walls were similarly adorned, and two or three handsome oaken cupboards and drawers were placed in the most convenient part of the room, while in the principal parlour a table stood in the middle with a nice set of tea things, all arranged, from the well-burnished heater to the silver spoon. The following particulars I obtained from the farmer's wife, about their method of making cheese :—After the cows are milked, and before the milk is cold, the rennet is added, till the curd is thoroughly formed. The whole milk is used for this purpose but a little, which is kept for cream. After the whey is separated from the curd, the latter is put into the *chessards*, which are of round form in the interior ; and the cheeses remain under the press for four hours. The press is of the simplest form, being a beam used as a lever, with a weight at the end. It is in general gaudily painted and gilt. The cheeses are then removed from the press and put into a pickle of salt and water, where they remain for twenty-four hours. From the pickle, they are put into cups made of wood, and salt is sprinkled on the tops of them ; they remain here eight days, being turned every morning upside down, and clean salt added. At the end of the eight days they are put into the pickle again for twenty-four hours. After this, they are taken out and allowed to dry for three weeks, linseed oil being rubbed on them every day, to prevent the cracking of the crust. They are generally sold at the end of this period. The practice of pickling prevails only in this district, which is called Brucker Meer. This part of the country has not been reclaimed from lakes, like the Beemster and Purmer, or, if it has, it is not in the memory of man. The soil is of inferior quality, and the cheeses made here are not esteemed so good as those made in the other two places. In them they allow the cheese to remain two days longer in the salt, instead of putting it into the pickle. The cows are never brought in in summer ; in winter they are fed on hay and water, and some farmers give oil-cake. A few pigs are also fattened from the whey, which is churned before being given to them. More people are employed on these small farms than would at first sight be thought necessary. This is owing to the expedition required in the operations. Cheese is made twice a-day on all the farms ; and from eighteen to twenty are made daily, from thirty-two cows, at the height of the season. The men's wages are from £6 to £10, with their meat, some perquisites, such as calves, and £1 twice a-year as presents at fair time and Christmas. Women receive £6 with their meat.

Thence we proceeded to Brock, about which most authors have spent their powers of exaggeration. The houses are built of

wood and painted green. The front doors and windows are never opened but on three occasions—a marriage, a birth, or a death. The streets are paved with clinkers or small bricks, which, in some places, are of different colours, probably giving rise to the idea of Mosaic, so often spoken of by authors. Carriages or horses are not allowed to pass through the streets. The gardens have all the absurdities of the Dutch taste about them. After a short drive from Brock, we enter upon one of those drained lakes so frequent in Holland, called the Purmer. In passing through them, we are placed in a very curious situation. The same level surface, dotted over with innumerable farm buildings, built in exactly the same manner, with an exact number of trees about them, with gardens laid out in exactly the same style, containing the exact number of cabbage plants and flower stalks, meets the eye in all directions, inclosed as its boundary by a high bank, on the other side of which a boat may be seen far above our heads, with distended sails, scudding along the waters of the canal. Assuredly we ride under the keels of the vessels, and the industrious inhabitants of these parts as truly dwell under the water. The farms in the Purmer are marked off by gates, and the subdivisions of each farm are made by ditches. After an hour's drive through the district, we arrived at Purmerende, where, fortunately, the great North Holland weekly fair was held that day. It is amusing for a stranger to walk through the streets at the time. He sees the people in their peculiar costumes, from the wide pantaloons and docked tail coat, to the court dress and cocked hat, with glittering buckles on the shoes. The women also do not fail to attract our attention, from their brilliant gold head-dresses, and bunches of silk curls over each temple, which are sported by all ages of the sex. The cheeses when sold are carried to the weighing-house, by a class of porters who run with their loads, roaring most vociferously all the way, to give warning of their approach to the bystanders, who meet with no civility from them if they obstruct their passage. The immense number of cheeses weekly sold here may give some conception of the number of people employed in making them. The passage in one part of the town was quite blocked up with the heaps which lay in rows along the streets, each heap containing about fifty cheeses.

About five miles drive from Purmerende brought us to the Beemster. The most careless observer can be at no loss to mark the commencement of this fertile tract of land. We pass at once from rank marsh vegetation to the most splendid fields of grass, surpassing in healthiness and beauty the best swept lawn of an English nobleman. We stationed ourselves on the top of the dyke, the only eminence near us, and surveyed with no

little pleasure the novel but not uninteresting scenery before us, the effects of the patient industry and untiring perseverance of a people whose country may be said to be the most remarkable in the world. As far as the eye could reach this level tract of land extended, richly green and unwaving on its surface, which was studded with innumerable farm houses, each surrounded with its well-pruned trees, and all around the gigantic windmills extended their arms to catch every passing breath of wind, while the whole prospect was enlivened by the handsome herds which fed in quietness on the rich herbage which the soil produced almost spontaneously. The farmers in the Beemster are many of them proprietors, and therefore we find in some parts of it more appearance of wealth, in the substantial houses and in the extensive and elegant gardens which surround them. The farmers' premises in these districts are generally all connected and under one roof. The form of the buildings is that of a square, with a low sloping roof at each side, which nearly reaches the ground, with now and then a small building jutting out from one of the sides.

The extent of North Holland is eighteen square miles, and it is kept dry or drained by forty-two windmills. Sometimes four or five windmills will be seen placed close to one another, raising the water from different levels, or, where there is a dead level, producing a run in the water, so that the working of the windmills may not be impeded. On coming out of the Beemster, we enter the Woermer, which is another drained lake, but far inferior to the Beemster in value. At one end of this extensive meadow lies Woermer Veer, which is a small village, and with Koech, Sandyke, and Saardam, forms a continuous street about four miles long. There is a canal at Woermer Veer, and considerable vessels sail in it; but still it betrays no symptoms of the filthiness to be found generally where there is much loading and unloading. On leaving the canal, the road, which is narrow, and paved with clinkers, and as clean as the floor of any gentleman's lobby, runs between, on the one side, a row of beautiful cottages, for the most part built of wood, and painted light green, with gabled fronts which terminate in a spire, and windmills, all having the appearance of being built yesterday, gaudily adorned with the most glaring colours and gilt, and thatched on the sides instead of being built of wood, but so neatly, as to look like one solid mass, instead of millions of straws bound together, and on the other a row of trees shading the road; a stagnant water, which is spanned in the length of these villages by no fewer than 500 small bridges, all similarly adorned as the houses, then another row of cottages, surpassing those on the other side in their whimsical embellishments, while every now and then we pass gardens, abounding in every variety

of flowers which the fortune of the possessors would enable them to purchase, and laid out with walks, which are paved with small stones and shells of different colours, and arranged into an endless set of fantastic forms. Such was my route for half an hour, till I reached Saardam, where Peter the Great learnt the art of ship-building. From Saardam our road lay along the top of a dyke, which restrains the waters of the Y to their proper bounds. The mills in this neighbourhood, which are more numerous almost than the houses, grind tobacco, crush linseed, and make paper. In an hour after leaving Saardam we were in Amsterdam, highly gratified with what we had seen during the day, and more than ever impressed with the unwearied perseverance of this people, and of their almost faulty habits of cleanliness.

P. McL.

ON THE CONSTITUTION OF THE POTATO PLANT.

By Alexander Geekie, Esq. of Baldowrie, Forfarshire.

The potato being a necessary article of food both for man and beast, any suggestions tending to throw light upon the cause of the failure continually recurring in such a crop must be of the first importance; and the following remarks are made with the view of explaining, to a certain extent, a very probable cause of that failure.

Regarding the evil to be in the potato tuber itself, and that it may be remedied by culture, it will be necessary to consider the constituent parts of the tuber, and the effects which these produce, by reaction, the one upon the other, under certain circumstances; also the different modes of culture at present adopted, and those which might be of use to secure, in some measure, healthy seed tubers. I have extracted largely from Liebig's agricultural chemical publications, considering that the statements therein made, although not directly applied to the potato plant, may yet tend to throw considerable light upon this subject, and especially when these statements are shewn to be alike applicable to the animal and vegetable kingdom, the probability of their correctness is very much strengthened. Thus the more we inquire into the laws of vitality, the more simple and uniform does nature appear in all her operations.

Under the microscope the potato tuber is found to be made up of cells filled with starch, and the cells themselves are composed of azotised substances, such as vegetable albumen, &c., therefore, in the culture of the potato plant it must at once be [illegible]ed that due regard should be had to the proper develope-

ment of these organs, by supplying the manures necessary for forming the cells, and at the same time filling them with starch, as without such a course being adopted healthy seed tubers cannot be expected. If we supply manures more adapted to forming starch than cells for holding it, an unhealthy tuber will be the consequence—one that is called a mealy potato—devoid of those azotised substances necessary for the proper formation of the frame-work of a tuber to be used as seed. A mealy potato I consider as similar to an over-fed animal loaded with fat, which fat is derived, according to Liebig, in a great measure from starch, and which renders the animal incapable of propagating its species with a degree of certainty, being, in such a state, more suited to the butcher than for breeding, as, "whenever there is a morbid production of fat, there is also a suppression of procreative life in all animals," specimens of which are exhibited at our great agricultural shows. A mealy potato is exactly in the same condition, being, as it were, over-fed with carbonaceous matter—a more agreeable and nourishing article of diet no doubt, but on that very account less suited for being used as seed.

The effects of heat upon starch are "peculiar, as, when it is exposed to a temperature about that of boiling water, it acquires a slightly red tint, emits an odour of baked bread, and is rendered soluble in cold water. It also suffers a similar modification by the action of hot water."* Starch, when in contact with decaying gluten, or nitrogenized substances, also suffers decomposition, being converted into sugar. These peculiarities of starch, caused by heat, moisture, &c., I consider have a decided effect in causing the failure of the potato plant; for, when a mealy potato is used for seed, it would be a difficult matter to check the changes which its abundant starch will undergo, as its constituent parts are in a favourable condition, by means of heat, for its azotised part to act upon and decompose the starch, thereby rendering the tuber unfit for vegetation, by making it incapable of giving support to the embryo plant, and producing dry-rot and decay.

It has been asserted by some that the cells of the potato are connected the one with the other, and by others, that they are not. Both opinions may be quite correct, as each will depend on the state of ripeness of the potato examined; for, if the tuber is surcharged with starch, the cells will naturally be broken, and run into one another, and injure the cellular structure, thus rendering it more liable to decay whenever the circumstances are favourable, such as when heat and moisture are present; whereas, if there is a deficiency of starch, the cells may appear quite unconnected and unruptured, hence not so susceptible of change from the above causes. The structure of the tuber is

* Turner's Chemistry, p. 683.

thus of great importance, as potatoes with unruptured cells, when cut for seed, it may reasonably be inferred, will not so fully discharge their starch, or be so readily acted upon by the external agencies of heat and moisture, and rendered so ready to undergo spontaneous decay. It will only be those cells which are cut that will discharge their starch, while the remainder cannot be acted upon, but will remain in their original state, so that any decay that may take place in the cut cells will not be communicated to the others, and the wound be soon healed up after being cut; whereas, when the cells are ruptured by an over-supply of starch, and are cut, a large discharge of starch immediately takes place from all the cells, and the starch being so liable to change, from apparently simple causes, a diseased state of the cut is soon produced, which either raises a weakly plant or none at all, and if, in some cases, a healthy plant do grow, it, no doubt, springs from a potato cut being properly formed in structure, some of which will always be found in the ripest fields.

In order to elucidate more clearly the difference in the structural formation of the potato tuber, and the probability, if not the certainty, of its being the cause of the failure of the potato crop, I shall give the following quotations from Liebig's works, which, although not adduced by himself to account for the potato failure, may tend to throw light upon it, and strengthen the idea as to a surplus of starch, produced by overculture, being the cause of the failure of the crop, by being the cause of a diseased tuber.

At page 71 of Animal Chemistry it is said that—

> Many varieties of fruit become ripe upon the tree, such as early or summer apples; others, again, ripen after being pulled, and kept for some time. The after-ripening, as this change is called, is a purely chemical process, entirely independent of the vitality of the plant. When vegetation ceases, the fruit is capable of reproducing the species, that is, the kernal, stone, or true seed, is fully ripe, but the fleshy covering from this period is subjected to the action of the atmosphere. Like all substances in a state of decay, it absorbs oxygen, and gives off a certain quantity of carbonic acid gas. In the same way as the starch in putrefying paste, in which it is in contact with *decaying gluten*, is converted into sugar, the starch, in the above-named fruits, in a state of decay or eromacausis, is transformed into grape sugar. The more starch the unripe fruit contains, the sweeter does it become when ripe. By means of a variety of chemical actions, which exert no other influence on the elements of starch than that of changing the direction of their mutual attraction, we can convert starch into sugar, but it is always grape sugar.

From the above may be inferred the benefit which the atmosphere will produce upon those potatoes intended for seed, by exposing them to the air, having taken the same up before being fully ripe—the atmosphere acting upon the starch of the tuber, causing it, to a certain extent, to disappear, or changing it into other substances, which otherwise, but for this, would have overloaded the cells; and, at the same time drying the tuber, so as to guard against after heating, and remove the causes of [illegible] amongst the constituent parts of the tuber, which other-

wise, but for this would have overloaded the cells, and at the same time thoroughly drying the potato, so as to prevent after-heating and reaction amongst the different parts of the tuber during winter; and this is an important point, for if putrefaction, or decay in any of its constituents, once commence, it will very soon extend itself to the whole tuber, and render it unfit for seed. At page 122 of Organic Chemistry it is stated—

If the quantity of their stems, leaves, and branches, has been increased by the excess of food yielded by the soil at the commencement of their developement, they will require for the completion of their growth, and for the formation of their blossoms and fruit, more nourishment from the air than it can afford, and, consequently, they will not reach maturity.

This hint may be of great use in the culture of the potato, in pointing out the result of increasing its growth by fully developing the cellular tissue, and causing it to get in advance of the formation of starch, and thus produce a healthy seed tuber. If the atmosphere is unable to supply the necessary carbonic acid to the leaves for forming a sufficiency of starch, it must be supplied to the roots from the soil by means of the decomposition of manure. At page 131 of Organic Chemistry it is stated—

Every fibre and every particle of wood is surrounded by a juice containing an azotised matter; while the starch granules are enclosed in cells formed of a substance containing nitrogen.

Again—

It is very probable that the wood, and the vegetable gluten, the starch granules, and the cells containing them, are formed simultaneously; and, in this case, a certain fixed proportion between them would be a condition necessary for their production.

According to this view, the assimilation of the substances generated in the leaves will, *ceteris paribus*, depend on the quantity of nitrogen contained in the food. When a sufficient quantity of nitrogen is not present to aid the assimilation of the substances which do not contain it, these substances will be separated as excrements from the bark, leaves, roots, and branches. In animals, if the substances which do not contain nitrogen preponderate, either they will be expended in the formation of fat or pass unchanged through the organism.

At page 133 it is said that—

A superabundance of carbon in the state of carbonic acid, conveyed through the roots of plants, without being accompanied by nitrogen, cannot be converted either into gluten, albumen, wood, or any other component part of an organ, but either will be separated in the form of excrements, such as sugar, starch, oil, wax, resin, mannite, or gum, or these substances will be deposited in greater or less quantity in the wide cells and vessels.

From these extracts will be perceived the absolute necessity of having the whole growth of the potato plant going on at the same time, and this can only be accomplished by supplying those manures requisite for fully developing its different constituent parts as they are required—first the azotised substances for forming the cellular tissue, and afterwards, or rather along with them, the carbonaceous substances for affording carbonic acid

to form starch. The azotised substances should always preponderate if seed-potatoes are wanted, and as to potatoes for feeding cattle or for the table, the more starch they contain the better, they should be supplied with carbonaceous manures, due care being always taken to have such a supply of azotised manure as to ensure a full crop; for, if this is neglected, the loss may be so great as not to be counterbalanced by the additional starch.

At p. 128 of Organic Chemistry it is said that—

The conversion of starch into sugar, during the germination of grain, is ascribed to a vegetable principle called diastase, which is generated during the act of commencing germination. But this mode of transformation can also be effected by gluten, although it requires a longer time. Diastase contains nitrogen, and furnishes the elements of vegetable albumen.

This shews the importance of a tuber intended for seed having the due quantity of azotised matter for even commencing the growth of the plant, indeed it cannot proceed without it, and as nitrogenous substances can only be found through the medium of the soil or from the atmosphere, such azotised manures should be used as will enable the plant to store up, in the tuber, a sufficiency of albumen which is necessary for commencing a healthy growth of the young plant in spring. Potatoes being grown from tubers instead of seed, these tubers must be so formed as to stand cutting into sets which shall not bleed, and this can only be effected by having the cellular tissue of the potato properly formed, and not so overloaded with starch as to rupture the cells, and thus produce a diseased tuber, which will be liable to go into decay whenever circumstances are favourable for such a change.

The special object of agriculture being to obtain an abnormal developement and production of certain parts of plants as well as of animals, the means used to obtain such results should be well considered; and, in the case of the potato, if we wish good healthy seed tubers, we ought to use azotised manures in excess, whereas, if starchy potatoes are wanted, we should use carbonaceous manures to a greater extent. It has occurred to me that, as mealy potatoes are a more agreeable article of food, they should be better calculated for feeding cattle, on account of their starch, than waxy ones, which, on the ether hand, should be better for developing muscle, on account of the nitrogen they contain; but this may be in too small quantity for such a purpose. Hence the analogy between a starchy potato and an over-fed animal; and hence also the reason may be seen why potatoes may be good for feeding but dangerous for breeding animals; for the excess of carbon supplying an excess of carbonic acid into the circulation by the lungs, the carbonic acid must either be thrown off by that organ to keep up health, or, on again being returned into the system, be deposited as fat. When much fat is deposited,

a diseased condition is very apt to be produced, as, when it accumulates without a due proportion of muscle, a morbid condition is sure to be superimposed, which, in course of time, renders the animal incapable of producing its own species, similar to the state of an over-starchy potato, which loses itself in the failure of the crop. By a continued course of this sort of breeding, the fattening quality becomes inherent in the race, and its breeding quality is, to a certain extent, deteriorated. Quite an opposite treatment to feeding is requisite to get the better of a fattening disposition, or, at all events, to keep it within profitable bounds, and at the same time preserve the breeding quality. By judicious feeding, such a tendency may be kept within proper bounds, by always keeping in view both the breeding and feeding qualities of the animal, not sacrificing early maturity and symmetry to coarseness of frame, &c. Similar treatment is applicable to the culture of the potato tuber. If for seed, supply those manures having azotised substances in abundance; if for starch, carbonaceous. The various modes at present adopted for the growth of healthy tubers, such as change of seed, succeeding at one time and not at another, will be seen to depend upon the nature of the soil from which they have been taken, upon the season, as also upon the time of planting, by all which causes the accumulation of starch may be readily effected. In being planted late, the growth of the plant is carried farther into the autumn, and the leaves run the risk of receiving a check from frost—circumstances which do not afford sufficient time for an over-accumulation of starch, but, at the same time, may lay the seeds of disease in the cellulose. Wet seasons tend to bring ammonia largely from the atmosphere into the soil, increase the vigour of the foliage, and develope cellular tissue, and thus make more accommodation of cells for the starch as it is formed. Farms which formerly have grown good seed, but are now subject to failures, may be changed in the constitution of their soils by cropping, and become earlier under a different course of culture. In all farms cultivated for a length of time, an accumulation of carbonaceous matter takes place, aiding the formation of starch, while an exhaustion of its azotised materials occurs, unfitting it for developing the cellular tissue of the potato, and there is likewise an exhaustion of those bases or salts which appear to be necessary for the proper developement of the different parts of the tuber. Without a due supply of all these materials, a good seed tuber cannot be raised, though a good crop of potatoes may be grown for eating, or feeding cattle, or manufacturing into starch. Potash seems to be the base chiefly required in the growth of the potato, though other bases may take its place; and, in soils overloaded with carbonaceous matter, the appli-

cation of lime will remove it by forming carbonate of lime. This change may be the reason why a little lime may be occasionally used advantageously, although its effects may not be visible in the luxuriance of the foliage, and it may render the soil more healthy and more to be depended upon for growing good crops by having set free the other bases in the soil. But I do not recommend the application of lime along with the potato, as I am afraid it would be highly injurious, increasing the accumulation of starch instead of checking it, and thus causing the soil to require a greater supply of azotised manures. Lime is better applied as a compost to the wheat after the potato crop has been removed. As to the growing of potatoes with different salts, the success or failure of such applications must depend in a great measure upon the soil to which they are applied; for, should they be already in the soil, their application is useless, and may even prove injurious: hence the success of an experiment upon one farm may prove a failure upon another, so that, unless the circumstances are favourable for the application, disappointment may ensue.

To recapitulate, in conclusion, consideration of the constituent parts of the potato, of their formation, and of the manures which tend to develope those respective parts, as also the time when the proper manure is required for each part, will tend, in no small degree, to put farmers upon a system of culture, as to its growth, that will enable them to raise more healthy seed; and this part of the crop may easily be separated from the other and raised upon that part of the field best suited for promoting the growth of the plant vigorously throughout the season. Starch being formed principally in autumn through the means of the leaves, its increase may easily be checked by cutting off the stems before the crop is ripe. The cells being first required, azotised manures should be from the first supplied, and kept up during the whole period of growth; and as, at the commencement of its growth, the plant solely depends upon the soil for its carbonic acid as well as its nitrogen, both should then be supplied from the manure, which, while it contains ammonia, should be well prepared beforehand for affording the necessary carbonic acid; for if ammonia alone is present, and if to alluvial soils, richer in azotised substances than light soils, rank ill-made manure, taken from the court-yard soaking with urine, rich in ammonia, be applied, a hard-hearted potato must necessarily be the produce. The leaves of a plant grown in such circumstances being vigorous, the plant, in course of time, will obtain carbonic acid from the atmosphere to form starch, and its roots also from the decay of the manure in the soil, so that an overdose of carbonic acid will be supplied, and a mealy outside will in consequence be formed. Thus then, at the commencement of the growth

of the potato, more cellular tissue is formed than there is starch to fill them, and a potato hard in the heart is produced, while in autumn more starch is formed by the leaves from the manure and atmosphere than there are cells to hold it, and thus a mealy outside is produced. These results shew the necessity of making a proper balance betwixt the different substances used as manures, and, as one soil may require different treatment from another, the application of special manures should be regulated accordingly. As at the commencement of growth, the leaves of the plant cannot assist in supplying the necessary carbonic acid, which can then only be obtained from the soil and manure, together with the due quantity of azotised substances and alkaline bases necessary for enabling the plant to assimilate the food that is presented to it, in order to form the different component parts of the tuber the manure should be properly prepared, to supply the necessary carbonic acid from the first, and an application of guano, or other ammoniacal manures, if thought necessary, will afford the requisite supply of nitrogen for forming the cells. Light soils are greatly benefited by the application of guano or similar manure, to increase the luxuriance of the crops grown upon them, and such soils do not contain ammonia in such abundance as alluvial soils. An abundant supply of carbonic acid, along with the azotised substances, should be afforded by the soil and manure throughout the entire growth of the plant, as the atmosphere is quite incapable of supplying all the carbonic acid which the plant requires for growing a heavy and profitable crop of potatoes, and it should be remembered that the value of the potato crop to the farmer, either for fattening cattle or for sale, depends upon an abundant supply of starch, to make the potatoes an agreeable and nourishing article of food. As for those intended for seed, an over-accumulation of starch may be guarded against by the application of azotised manure, and the cutting off the stems immediately after the plums have been fully developed, or about that period. The potato is thus allowed time to dry and ripen in the soil before being taken up, and is more easily kept during winter. The drying of the potato in the soil in this way is not attended with the risk of frost, which in our climate, at that late period of the year, must always be guarded against. By having these distinct ideas on the subject, and a practical acquaintance with the nature of the soil, a rational culture of the potato may to a certain extent be effected. It has occurred to me that manure made from cattle fed upon potatoes should be the best for again growing an abundant crop of potatoes, with an addition of guano for light soils, cattle appropriating few of the bases of the plant, but returning them in their excrements.

Since the preceding observations were written, a new diseas or perhaps the old one assuming a different form, from the plai being affected at an earlier stage of its growth, has shewn itse and to this latter opinion of the new affection being a more vir lent form of the old disease I am inclined to lean—the cellulo here being affected by external causes, and in the other by inte nal. The disease is said to have shewn itself upon all kinds soils, drained and undrained; but it must be allowed by all, th well-drained, well-wrought, and properly manured land, is in more favourable state for growing all kinds of produce healthi than land in an opposite state; that undrained land and a dan atmosphere are more injurious to vegetable as well as anim life than drained land and a dry atmosphere; that bad see from raising a weak plant, must, even on the dried land, be mo readily affected by cold weather than good seed; and wet seasoı by causing more luxuriance in growth, may place the plant in state more ready to suffer from the effects of cold than dry seaso would. Bearing these considerations in view, and knowing th hoar-frost has been very general in the early part of this seasc even in July, and knowing its injurious effects upon green veg table matter when growing, with a bright sunshine following, am inclined to think that this early hoar-frost has been the s cause of the failure. The stem, when green, being full of sap a easily affected by changes of temperature, soon goes to putrefa tion, which is soon communicated to the tuber through the incru ing matter of the cellulose, lying betwixt the cell and the star globule. Hence the whole plant goes to decay, those parts o not so liable to decay resisting the attack longer than the othe The hoar-frost, in ordinary seasons, may have had a similar in rious tendency, and in different degrees, though unobserved us, and the stem, while thus decaying, innoculating, as it we the tuber, which afterwards developes the disease, gives r to the various apparently, hitherto, inexplicable failures in t potato plant. The effects of the occurrence of frost this seas may tend to point out the true source of failure, and enable farm to guard against it, as far as practicable, by selecting healt seed from plants uninjured by external causes, and by preservi them properly during the winter, not excluding them from t air too soon.

If the potato plant be checked in the vigour of its growth, must be allowed that it is placed in an unnatural state, inasmu as it is not able properly to develope its constituent parts, a cannot, of course, be expected to produce a perfect tuber, or any rate one suited for raising a healthy plant. To guard agai the spread of the disease, those plants uninjured by frost sho alone be selected for seed, and their stems cut down a few we before the crop is lifted, to check an over accumulation of star

which tends to injure the cellular structure, and also to dry the tuber before it is lifted. The influence, too, of light and of the atmosphere, tend to place tubers in a better state for keeping during winter, as in the parts of the tubers which are above ground, and exposed to the influence of light, starch is much less abundant than in those below the ground. This, by the way, may be a highly useful lesson to the farmer in selecting turnips for seed, and in keeping them during the winter, by furrowing them up when in the earth or pitting them, and, by thus preserving them from the effects of light and air, make them more nourishing. It also shews how one part of a tuber or bulb may differ in nourishing quality from another.

When frost comes before the potatoes are lifted, it first affects the stem, and through it the tuber, thus laying the seeds of future decay. And where should this disease commence but in that part of the tuber most liable to change, lying betwixt the cellular tissue and the starch globules in the cells, called incrusting matter for want of a better name? It is highly probable that this is the substance from which the whole structure of the tuber is formed, as it naturally has a close connexion with the stem, and itself being in a state of change will be easily acted upon by external causes, such as the decay of the stem produced by hoar-frost, even in ordinary seasons, and much more in extraordinary; and it is more likely to be acted upon at an early period, when the tuber is imperfectly developed, and in a state of continued change, and in connexion with the full luxuriance of a watery stem. Thus it will be seen that a severe frost, some time before lifting the potatoes, may lay the foundation of future disease, and assist in producing the modified disease to which we have been accustomed. The tubers nearest the stem being likely first to be affected would cause one potato to be sound and another not, and, of course, produce good and bad plants in the same crop; but when the frost comes early in the season, as it has done in this, the tuber may go to decay even before the plant is taken out of the ground.

At page 205 of Mulder's Chemistry of Animal and Vegetable Physiology, it is said that "it is the incrusting matter which putrefies, the cellulose long resisting decay;" so this remark at once points to the seat of disease in the tuber, viz., the incrusting matter lying betwixt the cell and the starch globule within it. This incrusting matter is stated to be dissolved by alkalis, and by this means perhaps assimilated by the tuber, and where, in the growing potato plant, are these alkalis abundant but in its stem, the office of which is the formation of starch and cellulose, perhaps through the incrusting matter? If the stems, by frost or other external causes, be destroyed, the supply of the

alkalis is cut off, and the primary forces of the molecules are deranged, and the plant, ceasing to grow healthily, must go to putrefaction, commencing first with the decay of the stem where it was first attacked, and is soon communicated to the tuber, and where should the affection shew itself first in the tuber but in the incrusting matter, by its more immediate connexion with the stem? In the old disease I have frequently observed, when affected potatoes were cut, that a dark film shewed itself around the inside of the outer cellular covering of the tuber; and as it is likely that the stem communicates its influence to the whole tuber, first around it, and then through its whole structure, the disease is thus shewn to arise from external causes, modified by the condition of the soil and seed, as well as the locality.

If this view be correct, green potatoes should be selected for seed, and as, after the cutting off the stem, no decay can take place, that operation has quite a different effect from the cutting down by frost, as it always lays the foundation of future disease, which shews itself afterwards as rot or as a degenerate plant. By cutting the stem, the potatoes become thoroughly dried before being lifted, and, with exposure to the atmosphere, the tubers are rendered more fit for being kept in a healthy state. It may be objected to the cutting off the stem that the tubers are exposed to frost, which, however, may be easily guarded against by furrowing up the potatoes; but, indeed, should frost really come, protection from the stem is soon gone. Thorough draining, deep ploughing, and proper working the land, in so far as they remove the cause of hoar-frost and invigorate the plant, must render plants growing upon them more free from such attacks than plants which are differently treated.

When the potato plant is in full vigour of growth, there are more alkalis, as potash and soda, present than in autumn when the stem goes naturally to decay. Potash and soda being necessary for all plants rich in starch, their presence, in greater or less abundance, must exercise an important office in the functions of such plants, and all luxuriant stems, even in autumn, must contain the alkalis, whose principal office in the stem is apparently to prepare food for the tuber, and if hoar-frost come, and a hot sunny day succeed, putrefaction in the stem must be the consequence, and, in course of time, should the putrefactive matter not be removed, it will affect the tuber.

It would be highly interesting and instructive for the chemist or physiologist to point out the changes produced by frost upon the stems of the potato plant, and trace it down to the tuber, giving the analysis of good and bad stems, and of the incrusting matter, diseased and not diseased; likewise of potatoes in an advanced stage of their growth, as well as at their commencement;

because in all these different stages the disease may assume different forms in different soils, but ultimately the whole may be referred to the same cause.

All bulbous roots, or those accumulating starch, require alkalis to be applied along with azotised manures, in order to secure their full benefit, regulated according to the nature of the soil. Considering that in all bulbous roots, or tubers accumulating starch, a great uniformity may exist in the consequences following the changes of the season, the rotting of the turnips by frost and moisture may be a similar affection to the present rotting of the potato. It is well known that the rotting of turnips is the effect of frost, first commencing with the shaw—and that it appears first in low damp situations, and along rivers, facts which may assist in leading to a knowledge of the rottenness in the potato, by attending to the appearances and changes produced by it upon the substance of the turnip.

ACCOUNT OF THE HIGHLAND AND AGRICULTURAL SOCIETY'S GENERAL SHOW AT DUMFRIES IN OCTOBER 1845.

Galloway was the district in which the great annual Show of the Highland and Agricultural Society was held this year. This district comprehends the counties of Dumfries, Kirkcudbright, and Wigton; and to the lord-lieutenants, sheriffs, conveners, gentlemen, and farmers of these counties was the direct management of the show intrusted, while the adjoining counties of Ayr and Lanark, and the counties of Cumberland and Northumberland, over the English border, contributed largely to the exhibition. Dumfries, as being the most important town in the district, was selected as the site of the show.

We think it right to notice a question which was put to us by several persons, in order to satisfy the public mind as to the party who chooses the sites for these annual shows. It was asked that, as Dumfries is an inconvenient place for people to reach by coach, and still more so for stock by steam-boat, why the Society chose it for a place of exhibition? It should be clearly understood that the Society do not absolutely select the districts in which shows shall take place. They agree to hold a show in any district to which they are specially invited by the leading agriculturists residing in it, and who will guarantee a certain sum to be awarded as premiums; and, as much the largest share of all the premiums distributed at the shows is raised in the districts, the Society, as a matter of fairness, intrust the local

arrangements to those contributors of the money who are members of the Society, and, of course, the choice of the site is one of the arrangements which is placed at the discretion of the local committee; and, besides, members residing on the spot are naturally supposed to be the best judges of the locality which shall best suit for an exhibition of the stock of the district. But railways will soon make Dumfries as accessible as other places. Another of the local arrangements with which the Society do not absolutely interfere is the season when the show shall be held. But, in offering these explanatory remarks, we do not intend to say that the Society has now relinquished all control in fixing the time and place of the Shows. They still retain the power of control, and may exercise it whenever the occasion may call it forth, but, practically, the local members have the preliminary arrangements intrusted to them. There are two matters, however, with which the Society never interfere in any degree, namely, the mode in which the local funds are raised, and the procuring of the accommodation for the great dinners.

Last year, at Glasgow, the time chosen for the Show was August, the period at which the show had been held for several years. This year the people of Galloway chose October, the original period at which the shows were held for many years. We are not acquainted with the reasons which induced the old period to be revived. A show in August is supposed to interfere with the operations of an early harvest, as was found to be the case at Berwick-on-Tweed in 1842, and October was found this year at Dumfries to interfere with those of a late one. It is evident that a meeting in any of the months of August, September, or October is in danger of interfering with harvest operations. We have long held the opinion that the beginning of May is the period which would least interfere with farm operations, and at the same time would concentrate the largest display of farm produce, in the highest state of perfection. Bulls and stallions are then in their glory; cows are calved, and in full milk; ewes have their lambs at foot; fat stock of every description are in the highest condition; lean stock of every kind is in the freshest order; sheep are all rough in the wool; pigs and their litters are then most healthy; poultry are in the highest feather; the best seeds of the season could then be exhibited; and even the choicest roots might, till then, be preserved in a sound state. The only inmate of the farm then out of high condition is the tup. We should much desire to see a great show held at this season, in a fine farming district, such as Berwick; and, while speaking on the subject of shows, we should also desire to have an annual exhibition of fat stock of all kinds established at Edinburgh some time in January. The railroads now in progress in diffe-

rent parts of the country will soon present facilities for establishing such a show in the metropolis of Scotland.

The ground appropriated for the exhibition at Dumfries consisted of a part of the level haugh of dry land in old grass, called the Dock, situated on the margin of the Nith, on the same side of the river, and about half a-mile below the town. So much of this ground as was actually occupied by the exhibition extended from the edge of the river to the foot of the rising ground on which the Infirmary stands. It was inclosed with a high partition of stout boarding, embracing within it an area of several acres. The stalls for the horses and cattle occupied the entire circumference of this area, with the exception of the parts taken up with a number of gates, by which the stock and visitors found separate entrances. The pens for the sheep and pigs were placed towards one end of the show-yard and those for sheep and poultry were near the other end, while the implements occupied a double straight line, stretching from one division of those pens to the other. A long shed for the exhibition of dairy produce, and another for that of vegetable productions, stood in a line parallel with the lines of implements and between them and the cattle. The ladies' gallery was placed in a similar position on the opposite side of the ground, having the stage in front, upon which the prize stock are individually exhibited, and from which the premiums are announced, as also a covered orchestra for the band of music. The rooms for the acting Committee and Judges to meet in, as well as the refreshment room, were accommodated under the gallery. There was, besides, a large tent for breakfast, and another was appropriated for the smaller and more delicate articles exhibited, such as models and drawings. As a whole, the show-yard was very convenient, and looked well, and having the rising ground, with gardens and villas, on the east side, for a screen, it was well sheltered, while along the other side the beautiful Nith presented an ornamental and open scene. The view from the show-yard of the opposite bank of the river, and of the towns of Dumfries and Maxweltown in the distance, conjoined as these are by the fine old bridge spanning the river, could not fail to attract the notice of the lovers of the picturesque.

There were great and well-grounded apprehensions of the weather proving unfavourable for an exhibition of stock, but the greatest apprehension was for the safety of the erections on the show-ground after they were nearly completed, from an overflow of the river, in consequence of the heavy rains towards the end of the week previous to the show.

It rained all Friday, (says the *Dumfries Herald*,) and the Nith rose rapidly. In the afternoon the area of the show-yard was completely flooded, and fears began to be entertained for the wooden wall. About half-past nine o'clock in the evening the river was over the whole of the White Sands, inundating the lower parts of the Vennel and Kirkgate, and other streets, and reaching the very bottom of Assembly Street. About ten, the outer wooden wall of the show-yard, which ran

along the margin of the river, gave way, and was floated off instantly. A number of hurdles were also swept away. Saturday morning shewed the Nith subsiding. The show-yard scene, however, was a dreary one, and to make matters still gloomier, it rained more or less all Saturday. But the active hand of man was again at work; tile-drains were run up through the enclosed space, to draw off the water; everything was put to rights. It was soon generally admitted that the wall which had been carried off was not an essential part of the structure; and so men's spirits rose again. Sunday dawned beautifully, and continued fine throughout.

The ground, being naturally dry, was soon rendered firm by the draining. Very little rain fell during the three days of the show, and there was a good deal of sunshine, though there were showers under night. There was, therefore, cause for gratulation that, in so wet a season as this, three days should have consecutively passed of so agreeable a character as those which had been appointed for the show so long before.

The entire exhibition was thus divided over the three days:—On Tuesday the 7th were the trial and exhibition of agricultural implements, and the show of dairy produce, seeds, roots, and plants. On Wednesday the 8th was the general show of cattle, horses, sheep, swine, poultry, and the whole of the articles enumerated above, exhibited on Tuesday. And on Thursday the 9th was the exhibition of the prize stock, implements, and other articles.

It may prove interesting to give an abstract of the number of lots of every kind entered for exhibition.

Cattle.

Galloway Breed,	Aged Bulls,	11		
	Young Bulls,	11		
	Cows,	16		
	Spayed Heifers,	2		
	Oxen,	13		
	Heifers,	8		
	Heifers in Calf,	8		
	Stirks,	36		
			105	
Short-Horn Breed,	Bulls,	11		
	Bull Stirks,	10		
	Cows,	13		
	Heifers,	25		
			59	
Ayrshire Breed,	Aged Bulls,	8		
	Young Bulls,	4		
	Cows,	16		
	Heifers,	17		
			45	
West Highland Breed,	Oxen,		12	
Polled Breed,	Oxen,		2	
Any Breed,	Oxen,		5	
Extra Stock,	Bulls,	6		
	Cows,	14		
	Heifers,	10		
	Stirks,	9		
	Calves,	5		
	Oxen,	13		
			57	
Carried forward,				285 Cattle.

Brought forward,				285 Cattle.

Horses.

Draught Horses,	Stallions,	15		
	Mares,	10		
	Colts,	7		
	Fillies,	16		
			48	
Coach Horses,	Stallions,		8	
Extra Stock			19	
				75 Horses.

Sheep.

Leicester Breed,	Aged Tups,	13		
	Shearling Tups,	17		
	Ewes,	24		
	Gimmers,	27		
	Wethers,	6		
			87	
Cheviot Breed,	Aged Tups,	24		
	Shearling Tups,	42		
	Ewes,	40		
	Gimmers,	70		
	Wethers,	35		
			211	
Black-faced Breed,	Tups,	16		
	Ewes,	20		
	Gimmers,	60		
	Wethers,	10		
			106	
Southdown Breed,	Tups,	2		
	Ewes,	3		
			5	
Crosses,	Wethers,	40		
	Lambs,	40		
			80	
Extra Stock,			48	
				537 Sheep.

Swine,

Large and Small Breeds,	Boars,	11	
	Sows,	19	
	Pigs,	12	
Extra Stock,		20	
			62 Swine.

Poultry.

Turkeys,	16	
Dorking Fowls,	28	
Any other Pure Breed,	4	
Ducks,	28	
Geese,	10	
Any description of Poultry,	10	
Extra Stock,	5	
		101 Poultry.
Carry forward,		1060

Brought forward,			1060

Dairy Produce.

Cured Butter,	35		
Sweet Milk Cheese.	37		
Skimmed Milk Cheese,	12		
Extra Butter,	3		
Extra Cheese,	1		
			88 Dairy produce.

Seeds.

Wheat, White,	5		
Red,	1		
Spring,	4		
		10	
Barley,		2	
Oats, Potato,	2		
Hopetoun,	1		
Sandy,	3		
		6	
Beans,		3	
Perennial Rye-Grass Seed,		7	
New variety of grass Seed,		2	
Turnip Seed, Swedish,	6		
Green-top Globe,	2		
Yellow Bullock,	4		
		12	
			42 Seeds.

Roots.

Turnips, Swedish,	7		
Yellow Bullock,	5		
White,	2		
		14	
Potatoes,		13	
			27 Roots.
Improved Roots and Seeds,			4
Extra Seeds, Roots, and Plants,			12

Wool.

Fleeces, Cheviot and Black-faced	11	Wool.

Implements.

Collection of Implements,	1	Competitors	with	9	implements.	
New Implements,	10	—	—	14	—	
Design, Model, or Drawing,	4	—	—	8	—	
Improvements in subsoil plough	3	—	—	3	—	
— *common plough*,	11	—	—	12	—	
— *barn fanners*,	2	—	—	2	—	
— *farm cart and wheels*,	4	—	—	5	—	
[illegible]plements for potato an[illegible] [illegible]iv crop.	[illegible]		—	23	—	
[illegible]plemen[illegible] [illegible]airy h[illegible]a[illegible]	[illegible]		—	10	—	
[illegible] introdu[illegible] Scotland,	[illegible]		—	5	—	
Improved Tile Pip[illegible]	[illegible]		—	7	articles.	
Patented A[illegible]	[illegible]		—	45	—	
						143 Implements
						1,387 Lots.

On Tuesday, numerous committees and sub-committees were appointed to superinted the different departments of the business of the show on this and the succeeding days, and the following gentlemen were also requested to act as judges of the various classes of objects enumerated below:—

Of the Galloway Breed.—Mr John M'Queen, Auchinhay; Mr Robert M'Monies, Chapel; Mr Alexander Craig, Bighouse, Sutherlandshire; J. B. Fernie, Esq. of Kilmux, Fifeshire, and Mr John Stronyan, Barr, Newtown Stewart.

Of the Short-horn Breed.—John Heriot, Esq. of Foleyhills, Berwickshire, and Mr William Bartholomew, Goltho, Lincolnshire.

Of the Ayrshire Breed.—Mr David Tenant, Howwell, and Mr John Buchannan, Finnich.

Of the West Highland Breed.—Mr Donald M'Donald, Craigruie, and Mr William Gillespie, Gateside, Douglas.

Of the Polled Breeds.—Mr Craig, Mr Fernie, and Mr Stronyan.

Of any Breed.—Mr Heriot and Mr Bartholomew.

Of Horses.—Professor Dick, Edinburgh; Mr Williamson, Veterinary Surgeon, Edinburgh; Mr Andrew Black, Smeaton, Dalkeith Park, and John Campbell Renton, Esq. of Mordington, Berwickshire.

Of Leicester Sheep.—Mr John Grey, Dilston, Northumberland, and Mr Adam Brack Boyd, Cherrytrees, Roxburghshire.

Of Cheviot Sheep.—Mr Robert Tod, Cardrona Mains, Peebless-shire, and Mr James Murray, Craigend.

Of Black-faced Sheep.—Mr M'Donald and Mr Gillespie.

Of Southdown Sheep.—Mr John Dudgeon, Spylaw, Roxburghshire, Mr Andrew Byres, and Mr Walter Carruthers.

Of Crosses.—Mr Dudgeon, Mr Byres, and Mr Carruthers.

Of Swine.—Mr Grey and Mr Tod.

Of Poultry.—Sir William Jardine, Bart., of Applegarth, Dumfriess-shire; Hugh Corrie, Esq., younger of Steilston, and Mr Shaw, Drumlanrig Castle.

Of Dairy Produce.—Mr Francis Richardson, Edinburgh, and Mr James Biggar, Maryholm, Dumfriesshire.

Of Implements.—Professor Low, Edinburgh; W. M. Alexander, Esq. of Ballochmyle; Mr Dalzell, Whitehouse Villa, Edinburgh; George Turnbull, Esq. of Abbey St Bathans, Berwickshire; Mr Smith, late of Deanston, and Mr Scoular, Haddington.

Of Roots and Seeds.—Sir William Jardine, Mr Lawson, Edinburgh, Mr Little, Carlisle, Mr Brack Boyd, Mr Dudgeon, and Captain M'Murdo.

The judges of dairy produce, roots, and seeds, and of implements, were engaged in their duties on Tuesday; those of stock on Wednesday. We now proceed to enumerate the awards of premiums in the order in which the exhibitions took place; and shall not repeat the number of competitors at the head of each particular class, but refer generally to the list given above.

I.—Dairy Produce.

1. *Curing Butter.*

To the owner of any Dairy who made and cured the best quality of Butter for the market, not being less than two cwt., during the season 1843—the premium of five sovereigns, to No. 30, belonging to James Rome, Allerbeck, Dumfriesshire.

For the second best quality of ditto—the premium of three sovereigns, to No. 2, belonging to Alexander Aitkenhead, Barskevin, Renfrewshire.

An extra premium was awarded to Robert Osborne, Dalscone, near Dumfries.

The general quality of the butter was considered by the judges as very good, and the state in which it was presented for exhibition evinced attention, neatness, and cleanliness.

2. *Making Cheese.*

For the best specimen of Sweet or Full Milk Cheese, made of any variety that he finds most profitable for the market—the premium of five sovereigns, to No. 37, belonging to John Young, Nether Kirkcudbright, Dumfriesshire.

For the second best ditto—the premium of three sovereigns, to No. 15, belonging to Thomas Kennedy, Chapelhill, Dumfriesshire.

The judges commended the cheeses of James Moffat, Gateside, near Sanquhar, Dumfriesshire, as being very handsome and well made, and those of James M'Adam, Clearie, Newtown-Stewart, Wigtonshire, as worthy of notice.

For the best quality of Cheese from Skimmed Milk, made for sale during the season of 1845, not being less than one cwt.—the premium of five sovereigns, to No. 6, belonging to Janet M'Kay, Chapel Dairy, Dumfriesshire.

For the second best quality of ditto—the premium of three sovereigns, to No. 8, belonging to William Muir, Hardington Mains, Dumfriesshire.

II.—Seeds and Roots.

For the best and approved sample of White Wheat, of any variety—the silver medal, to No. 2, belonging to Thomas Laurie, Terreglestown, Dumfriesshire.

For the best and approved sample of Red Wheat, of any variety—the silver medal, to No. 1, belonging to William Watts, Craigs, Dumfriesshire.

For the best and approved sample of Spring Wheat—the silver medal, to No. 4, belonging to John Mackenzie, Barnhill, Dumfriesshire.

For the best and approved sample of Barley, of any variety—the silver medal, to No. 2, belonging to John Mackenzie, Barnhill.

For the best and approved sample of Potato Oats—the silver medal, to No. 2, belonging to George Riddick, Greenhillhead, Dumfriesshire.

For the best and approved sample of Hopetoun Oats—the silver medal. Not awarded.

For the best and approved sample of Sandy Oats—the silver medal, to No. 3, belonging to Robert Osborne, Dalscone, Dumfriesshire.

For the best and approved sample of Beans, of any variety—the silver medal. Not awarded.

For the best and approved sample of Perennial Rye-Grass Seed, of any variety—the silver medal, to No. 2, belonging to Thomas Biggar, King's Grange, Kirkcudbright.

An extra premium was awarded to Alexander Watt, Gainleitch, Ayrshire.

For the best and approved sample of any new variety of Grass Seed, introduced into the culture of the farm—the silver medal, to No. 2, belonging to Thomas Biggar, King's Grange.

For the best and approved sample of Swedish Turnip Seed—the silver medal, to No. 5, belonging to William Skirving, Walton, Lancashire.

For the best and approved sample of Greentop Globe Turnip Seed—the silver medal, to No. 1, belonging to Thomas Kennedy, Dumfries.

For the best and approved sample of Yellow Bullock Turnip Seed—the silver medal, to No. 1, belonging to John Corrie, Gallowberry, Dumfriesshire.

For the best and approved sample of 20 Roots of Swedish Turnips, of any variety—the silver medal, to No. 7, belonging to John Mackenzie, Barnhill, Dumfriesshire.

For the best and approved sample of 20 Roots of Yellow Turnips, of any variety—the silver medal, to No. 1, belonging to James Connell, Conheath, Dumfriesshire.

For the best and approved sample of 20 Roots of White Turnips, of any variety—the silver medal, to No. 1, belonging to Thomas Laurie, Terreglestown, Dumfries.

For the best and approved sample of 20 Roots of any other plant suited to field culture—the silver medal. No competitor.

For each of the two best and approved varieties of Potato suited for the Table—the silver medal, to No. 10, belonging to William Osborne, Dalscone,

Dumfriesshire, for a variety named *Buffs*, and also to No. 5, for Potatoes named *New York Whites*, belonging to William Gordon, Castlehill, Dumfriesshire.

And for the best and approved Potato for Feeding Cattle—the silver medal, to No. 13, named *Barny's Potato*, belonging to Francis Wood, Jardington, Dumfriesshire.

To each of the four best and approved samples of Seeds and Roots, not falling within any of the classes above enumerated—the silver medal. No competitor.

For the best and approved Collection of Seeds, Roots, and Plants exhibited by any one competitor—the premium was awarded equally between Peter Lawson & Son, the society's seedsmen, and Thomas Kennedy, seedsman, Dumfries.

Amongst the general collections exhibited, that of Messrs Lawson & Son, seedsmen to the Society, as usual, stood pre-eminent, and contained some new specimens of seeds and plants. The judges noticed the following articles in particular among the collections of Messrs Lawson and Mr Kennedy; and first, of those exhibited by Messrs Lawson, were—

110 distinct varieties of wheat, 6 of rye, 26 of oats, and 35 of barley, including new varieties from the Himalaya Mountains, Abyssinia, and Chinese Tartary. A collection of grasses, and other herbage and forage plants used in agriculture, with samples of seed illustrative of their treatise on the cultivated grasses. Of plants, there were the *Hordeum bulbosum*, Bulbous barley; Bokhara clover; *Bromus Schraderi*, a new plant; samples and specimens of the Alsike clover; *Elymus Sibericus*, *Bromus giganteus*; and a growing specimen, 18 inches in height, of the *Dactylis cæspitosa*, or Tussac grass, raised from the seed sent to the society by Lord Stanley, the Colonial Secretary, from the Falkland Islands. Captain M'Murdo, one of the judges, identified this plant as a specimen of the true Tussac grass. There were tubers of the Conqueror potato, a new and productive variety, from the Orkney Islands, four stems of which produced 84 lbs. of potatoes. The collection of Mr Kennedy of Dumfries was also excellent, containing a great variety of specimens of natural grasses and of grain; a specimen of each kind of forest tree; 36 varieties of potato, and fine specimens of turnips, carrots, Drumhead cabbage, and Kohl Rabi, all of which the judges highly commended.

III.—Implements.

For the best Collection of Agricultural Implements and Machines of any description, manufactured by or under the superintendence of the Exhibitor, just proportion of parts, workmanship, utility, and price, being considered—the premium of five sovereigns, or the medium gold medal, to No. 1, to R. Gray and Sons, implement makers, Uddingstone, Lanarkshire; and two sovereigns to William Smith, Lochthorn, Dumfriesshire.

For any new and useful Agricultural Implement or Machine, that has been satisfactorily tested in actual work, not previously exhibited in competition—the premium of five sovereigns, or the medium gold medal, to No. 5, John Geddes, Cargen Bridge, Kirkcudbright, for a Drill Sowing-Machine; and to No. 9, to Robert M'Turk of Hastingshall, Minnyhive, for a Simple Stack Ventilator—the silver medal.

For any Design, Model, or Drawing of any new Machine, or Implement applicable to any useful purpose connected with Agriculture, which may, in the opinion of the judges, promise to be successful in accomplishing the object intended—the silver medal, to No. 3, to Mr Crosskill, Beverly Ironworks, Yorkshire.

For such useful Improvement in the construction of the Subsoil Plough as may be best suited to accomplish the main object of subsoil ploughing, viz.—moving, breaking, stirring, and effectually detaching the subsoil from its own substratum, without bringing it to the surface—the premium of seven sovereigns, to No. 1, to James Anderson, Howwood, Renfrewshire—for a Subsoil Plough or Grubber—three sovereigns.

For any useful Improvement in the construction of the common Two-horse

Plough, which has for its object the lifting and turning over the greatest quantity of the soil in a given time, with the least resistance to the draught, and which produces, at the same time, a fair and efficient surface for exposure or for seed. In this class the judges were of opinion that the several articles deserved notice for the endeavours to improve the common Plough, and for the goodness of the workmanship;—but as the Ploughs did not exhibit such improvements as to bring them within the terms of the premium, they awarded twenty-two sovereigns for expenses among the competitors—eleven in number.

For any useful improvement in the construction of Barn Fanners—the premium of five sovereigns. No premium awarded.

For any useful improvement in Farm Carts and Wheels—the premium of three sovereigns, to No. 1, to Robert Crawford, Uddingstone, Lanarkshire, for a Cart with an Improved Double Lock.

For any useful improvement on the Thrashing-Machine, particularly on the Drum, having for its object the saving of horse-power and producing clean work—the premium of six sovereigns. No competition.

For the most useful improvement in the construction of any of the implements used in the cultivation of the Turnip and Potato Crops—the premium of one and a-half sovereign, to No. 1, to John Affleck and Co., Palmerston, for a Turnip-Drill xhibited by them; and also one and a-half sovereign to John Wightman, the ventor.

To John Birkett Stainton, Milton, for a Double Plough—the silver medal.

For the most useful improvement in any of the Utensils or Machines used in Dairy Husbandry—to No. 3, the silver medal to Robert Miller, Balgray, Dumriesshire.

To Richard Robinson, Lisburn, Ireland, for Churns exhibited by him, five sovereigns, to be divided equally between him and the Inventors, John Rowan and Sons, Ballyclare, Ireland.

To the Implement Maker who shall have successfully introduced into Scotland, of his own manufacture, any Machine or Implement that is generally approved in the practice of Agriculture in England or elsewhere, or a Modification of the same, and which has hitherto been but little known or employed in Scotland—the premium of five sovereigns. A premium would have been awarded to Mr Crosskill, had he not received one previously for his Clod-Crusher.

To Richard Robinson, Lisburn, five sovereigns, for the Steaming Apparatus exhibited by him; and the silver medal to Josiah Jennings, New York, as being partly the Inventor.

For a Weighing Machine, adapted to general Farm Purposes, capable of weighing Stock or Produce, dead or alive, from the weight of a Sheep to that of a Loaded Cart, and which will indicate the addition of 1-500th part of the mass to be weighed—the premium of five sovereigns. No competition.

For any improved Tile Pipe, or other invention for securing the run of water in drains, possessing the advantages of cheapness and durability, combined with efficiency—the premium of ten sovereigns. No premium awarded.

For approved Patented Articles, and Articles not coming within the range of any of the foregoing Articles:—

To No. 1, John Ainslie, Alperton, Middlesex, for his Patent Hand Drain-Tile Machine—the medium gold medal or five sovereigns. To No. 4, to Robert Boyle, Ayr, for his Patent Tile Machine—the medium gold medal or five sovereigns. To No. 5, to John Henry Charnock, Wakefield, Yorkshire, for his Drain-Tile and Pipe Machine—three sovereigns. To No. 19, to John Weir, Dumfries, for the Good Workmanship and Cheapness of the Saddlery exhibited by him—the silver medal. To No. 20, to John West, Lundie, Forfarshire, for his Mole Plough, which may be used as a Subsoil Plough—two sovereigns. To No. 21, to Messrs Young, Edinburgh, for their Portable Sheep Rack—the silver medal. The Committee expressed their favourable opinion of the Quality and Cheapness of Messrs Young's Wire and Iron Work. To Richard Colman, Colchester, for his Expanding Lever Harrow—three sovereigns. To James Kirkwood, Tranent, East Lothian, for his Harrow for Breaking and Pulverising Land—three sovereigns. To Norman Lockhart o[illegible] anarkshire fo[illegible]ntroduction of Norwegian Harrows—two sovereigns

Trial of several of the implements prior to the award of the above premiums was made on Tuesday forenoon, in a field belonging to Mr Thorburn, near Maryfield, about half-a-mile from the show-yard, under the superintendence of the Judges.

IV.—CATTLE.

Galloway Breed.

As might have been expected from the district, a large number and variety of this breed were presented for exhibition.

For the best Bull, calved between 1st January 1839 and 1st January 1843—the premium of thirty sovereigns, to No. 1, belonging to the Duke of Buccleuch.

For the second best ditto—the premium of fifteen sovereigns, to No. 10, belonging to John Rain, Callymains, Kirkcudbright.

The honorary silver medal to Mr Marshall, Kirkcudbright, as the Breeder of the best Bull.

For the best Bull, not exceeding thirty-three months old—the premium of ten sovereigns, to No. 11, belonging to Stair H. Stewart of Glasserton, Kirkcudbright.

For the best two Breeding Cows, belonging to the same stock, calved prior to 1st January 1843—the premium of fifteen sovereigns, to No. 1, belonging to James Gillespie, Annanbank, Dumfriesshire.

For the best single Breeding Cow, calved prior to 1st January 1843—the premium of ten sovereigns, to No. 1, belonging to the Duke of Buccleuch.

For the second best ditto—the premium of five sovereigns, to No. 5, belonging to John M'Fiee, Borland, Dumfriesshire.

For the best two Spayed Heifers, calved after 1st January 1842—the premium of ten sovereigns. No competition.

For the best two Spayed Heifers, calved after 1st January 1843—the premium of ten sovereigns, to No. 1, belonging to the Duke of Buccleuch.

For the best Ox, or Spayed Heifer, of any age—the premium of ten sovereigns, to No. 1, belonging to Hugh Corrie, Newtonaird, Dumfriesshire.

For the best two Oxen, calved after 1st January 1842—the premium of ten sovereigns, to No. 2, belonging to Stair H. Stewart of Glasserton, Wigtonshire.

For the second best two ditto—the premium of five sovereigns, to No. 1, belonging to Colonel James M'Douall of Logan, Wigtonshire.

For the best two Oxen, calved after 1st January 1843—the premium of ten sovereigns, to No. 1, belonging to the Duke of Buccleuch.

For the second best two ditto—the premium of five sovereigns, to No. 2, belonging to Colonel James M'Douall.

For the best two Heifers, calved after 1st January 1843—the premium of ten sovereigns, to No. 1, belonging to John Halliday, Moloch, in Rerwick, Kirkcudbright.

For the second best two ditto—the premium of seven sovereigns, to No. 3, belonging to William Sproat, Borness, Kirkcudbright.

For the best single Heifer, in calf—the premium of five sovereigns, to No. 1, belonging to the Duke of Buccleuch.

For the best lot of Stirks, calved after 1st January 1844, being not under one-half of those bred on the farm, and not fewer than four in number—the premium of ten sovereigns, to No. 7, belonging to William Sproat.

For the second best ditto—the premium of five sovereigns, to No. 3, belonging to Alexander Halliday, Culcraigie, Kirkcudbright.

Short-Horn Breed.

There was little expectation that the district would supply many of this breed of cattle, and yet those exhibited were good, and

their presence evinced that the breed is making its way in this as well as in every other low district of the country.

For the best Bull, calved between 1st January 1841 and 1st January 1843—the premium of thirty sovereigns, to No. 3, belonging to C. W. Harvey, Walton, Lancashire.

For the second best ditto—the premium of fifteen sovereigns, to No. 5, belonging to William Jobson, Chillingham Newton, Northumberland.

The honorary silver medal, to C. W. Harvey, as the Breeder of the best Bull.

For the best Bull Stirk, calved after 1st January 1844—the premium of fifteen sovereigns, to No. 2, belonging to David Hill of Edenhall, Cumberland.

For the second best ditto—the premium of seven sovereigns, to No. 5, belonging to William Tod, Elphinstone Tower, East Lothian.

For the best Breeding Cow, calved prior to 1st January 1843—the premium of ten sovereigns, to No. 1, belonging to W. T. Carruthers of Dormont, Dumfriesshire.

For the best Heifer, calved after 1st January 1843—the premium of ten sovereigns, to No. 3, belonging to W. T. Carruthers.

For the best two Heifers, calved after 1st January 1844—the premium of ten sovereigns, to No. 1, belonging to W. T. Carruthers.

The cow belonging to William Little, Rose Castle, near Dalston, county of Cumberland, and that of Thomas Rome, Baurch, near Gretna, Dumfriesshire, were commended by the judges as possessing great merit.

Ayrshire Breed.

Of this breed the exhibition seems to have been confined to the produce of the district, very few having been sent from the best districts of Ayrshire and Lanarkshire.

For the best Bull, calved between 1st January 1840 and 1st January 1843—the premium of fifteen sovereigns, to No. 5, belonging to George Lorimer, Kirkland, Dumfriesshire.

For the second best ditto—the premium of seven sovereigns, to No. 3, belonging to Lawrence Drew, Carmyle, Lanarkshire.

The honorary silver medal, to Lawrence Drew, as the Breeder of the best Bull.

For the best Bull, calved after 1st January 1843—the premium of five sovereigns, to No. 2, belonging to James Grierson, Morton Mains, Dumfriesshire.

For the best Milch Cow, calved prior to 1st January 1842—the premium of ten sovereigns, to No. 4, belonging to William Young Herries of Spottes, Kirkcudbright.

For the second best ditto—the premium of five sovereigns, to No. 15, belonging to James Wilson, Old Mill, Ayrshire.

For the best two Heifers, calved after 1st January 1843—the premium of seven sovereigns, to No. 13, belonging to William Muir, Hardington Mains, Lanarkshire.

For the second best two ditto—the premium of five sovereigns, to No. 12, belonging to James Muir, Castledykes, Lanarkshire.

West Highland Breed.

There was no competition in the breeding animals of this kind of cattle, the exhibition being confined to fat oxen.

For the best two Oxen, calved after 1st January 1841—the premium of ten sovereigns, to No. 5, belonging to Archibald Stirling of Keir, Stirlingshire.

For the best two Heifers—the premium of five sovereigns. No competition.

Polled Breeds.

None of the polled breeds of Forfarshire and Aberdeenshire came to compete with the polled oxen of Galloway.

For the best Ox of the Galloway, Aberdeen, or Angus Polled Breeds, calved after 1st January 1841—the premium of ten sovereigns, to No. 2, belonging to Stair H. Stewart of Glasserton, Wigtonshire.

Any Breed.

There were some fine oxen of this class, both of the Short-horn and Galloway breeds, as well as crosses between them. It will be observed that the Galloways carried off the prize.

For the best Ox of any kind, pure or cross, of any age, the particulars of the breed being specified—the premium of ten sovereigns, to No. 2, belonging to Colonel James M'Douall of Logan, Wigtonshire.

V.—Horses.

Draught and Coach Horses.

The display of draught stallions was good, as also of a few mares, and there was a considerable number of excellent fillies. The coach stallion which gained the premium was a very handsome horse, of great spirit and good temper, and having fine free action. His portrait for the Picture-Gallery of the Society's Museum was intrusted to the artistic care of Mr Gourlay Steell of Edinburgh.

For the best Stallion, from three to ten years old, for breeding Draught Horses—the premium of forty sovereigns, to No. 13, belonging to Thomas Richardson, Solemain, Cumberland.

For the second best ditto—the premium of twenty sovereigns, to No. 11, belonging to John Paterson, Killeonan, Argyleshire.

For the best Stallion, from three to ten years old, for breeding Horses for Coach or Chariot—the premium of twenty sovereigns, to No. 4, belonging to Robert Moffat, Newtown of Rockliffe, Cumberland.

For the best Mare for breeding Draught Horses, and which shall have been at least one year in the possession of the Competitor—the premium of fifteen sovereigns, to No. 1, belonging to John Bartholomew, Broomhill, Dumbartonshire.

For the second best ditto—the premium of ten sovereigns, to No. 2, belonging to John Birrel, Guards Farm, Cumberland.

For the best three-year-old Draught Gelding—the premium of five sovereigns, to No. 1, belonging to Robert Hiddleston, Riddingwood, Dumfriesshire.

For the best two-year-old Draught Gelding—the premium of five sovereigns, to No. 6, belonging to Thomas Struthers, Gilfoot, Kirkcudbright.

For the best three-year-old Draught Filly—the premium of five sovereigns, to No. 5, belonging to Thomas Smith, Dalfibble, Dumfriesshire.

For the best two-year-old Draught Filly—the premium of five sovereigns, to No. 11, belonging to Reginald Tinning, Chapeltown, Cumberland.

The two Stallions, *Idleboy* and *Vulcan*, belonging to James Wilkin, Tinwald Mains, near Dumfries, were considered by the judges as particularly handsome, but, being thorough-bred, they did not properly belong to the class of carriage horses in which they were entered.

VI.—Sheep.

1. *Leicester Breed.*

The show of this breed was superior to what may have been expected from the district, and though many of the animals came from a distance, particularly from the English Border, there were a sufficient number of local entries to evince that this breed, like the short-horn cattle, are finding their way in all the lower parts of the country.

For the best Tup, not exceeding five years old—the premium of ten sovereigns, to No. 9, belonging to William Smith, Burton, Northumberland.

For the second best ditto—the premium of five sovereigns, to No. 5, belonging to Thomas Howey, Lilburngrange, Northumberland.

For the best Shearling Tup—the premium of five sovereigns, to No. 14, belonging to William Smith, Burton, Northumberland.

For the best pen of three Ewes, not less than two years old—the premium of five sovereigns, to No. 6, belonging to William Parker, Yanwath Hall, Cumberland.

For the best pen of three Gimmers—the premium of five sovereigns, to No. 9, belonging to Randle W. Saunders of Nunwick Hall, Cumberland.

For the best pen of three Fat Wethers, not exceeding twenty months old—the premium of three sovereigns, to No. 2, belonging to William Marshall, Kirkland, Kirkcudbright.

2. *Cheviot Breed.*

This was, without exception, the finest exhibition of this breed, both for purity of blood and condition, that we ever saw at the Society's Shows; and their large number was imposing.

For the best two Tups, not exceeding forty-five months old—the premium of ten sovereigns, to No. 3, belonging to James Bryden, Moodlaw, Dumfriesshire.

For the second best two ditto—the premium of five sovereigns, to No. 1, belonging to William Aitchison, Menzion, Peeblesshire.

For the best three Shearling Tups, bred by the Exhibitor—the premium of seven sovereigns, to No. 7, belonging to John Murray, Dean's Houses, Peeblesshire.

For the second best three ditto—the premium of five sovereigns, to No. 1, belonging to William Aitchison, Menzion.

For the best three Shearling Tups, the property of the Exhibitor, without reference to the Breeder—the premium of five sovereigns, to No. 4, belonging to Robert Elliot, Hardgrave, Dumfriesshire.

For the best pen of ten Ewes, not exceeding six years old, selected from a regular breeding stock of not fewer than two hundred—the premium of ten sovereigns, to No. 3, belonging to James Bryden, Moodlaw.

For the second best pen of ten ditto—the premium of five sovereigns, to No. 4, belonging to Thomas Little, Pennyland, Dumfriesshire.

For the best pen of ten Gimmers, selected from a regular breeding stock of not less than two hundred Ewes, and kept with the breeding stock until the period of the Show—the premium of five sovereigns, to No. 5, belonging to Thomas Little, Pennyland.

For the best pen of five Fat Wethers, not exceeding thirty-two months old—the premium of five sovereigns, to No. 2, belonging to Charles Stewart, of Hillside, Dumfriesshire.

For the best pen of five ditto, not exceeding twenty months old—the premium of five sovereigns, to No. 3, belonging to Charles Stewart, Hillside.

3. *Black-faced Breed.*

These also made a good exhibition, though we had expected a larger number from so fine a district.

For the best two Tups, not exceeding forty-five months old—the premium of ten sovereigns, to No. 3, belonging to Mr Adam Blacklock, Minnygate, Dumfriesshire.

For the second best two ditto—the premium of five sovereigns, to No. 2, belonging to Mr Adam Blacklock.

For the best pen of ten Ewes, not exceeding six years old, selected from a regular breeding stock of not fewer than two hundred—the premium of ten sovereigns, to No. 1, belonging to James Milligan of Hayfield, Dumfriesshire.

For the second best pen of ten ditto—the premium of five sovereigns, to No. 2, belonging to Thomas Reid, Trollos, Lanarkshire.

For the best pen of ten Gimmers, selected from a regular breeding stock of not fewer than two hundred Ewes, and kept with the breeding stock until the period o the Show—the premium of five sovereigns, to No. 3, belonging to James Milligan.

For the best pen of five Fat Wethers, not exceeding fifty-six months old—the premium of five sovereigns to No. 2, belonging to David Scott, Northfield, East Lothian.

4. *Southdown Breed.*

This fine breed of sheep has not yet found its way into this quarter in sufficient numbers to produce an effect.

For the best Tup—the premium of ten sovereigns, to No. 2, belonging to Walter M'Culloch of Kirkclaugh, Kirkcudbright.

For the best pen of three Ewes—the premium of five sovereigns. Not awarded.

For the best three Wethers, shewing most symmetry, fat, and weight—the premium of five sovereigns. No competition.

5. *Crosses.*

The cross that receives the greatest approval from the breeders of sheep is with the Leicester tup, and it certainly never fails to impress both symmetry and aptitude to fatten upon the progeny.

For the best pen of five Fat Wethers, a cross between a Leicester Tup and Cheviot Ewes, not exceeding twenty months old—the premium of five sovereigns, to No. 3, belonging to Robert Smith, Ladyland, Kirkcudbright.

For the second best pen of five ditto—the premium of three sovereigns, to No. 2, belonging to James Mitchell, Bankhead, Dumfriesshire.

For the best pen of five Fat Wethers, a cross between a Leicester Tup and Black-faced Ewes, not exceeding twenty months old—the premium of five sovereigns, to No. 1, belonging to J. J. Hope Johnstone of Annandale, M.P., Dumfriesshire.

For the best pen of five Fat Wehers, of any cross, under thirty-two months old—the premium of five sovereigns, to No. 3, belonging to William Wright, Bengal, Dumfriesshire.

For the best pen of ten Lambs, from Cheviot Ewes by a Leicester Ram, or any long-wooled Ram, dropt subsequently to 1st March 1845, shewn by the breeder—the premium of five sovereigns, to No. 3, belonging to Archibald Rodan, Duncow, Dumfriesshire.

VII.—Swine.

Large and Small Breeds.

Dumfriesshire having been long famed for its hams, a good exhibition of pigs was reasonably to be expected, and the specimens of those useful animals presented for exhibition certainly created no disappointment. The small breed, and most deservedly, seems to be gaining ground in this district, as it ought in every other. For the credit of this district, we cannot refrain expressing our belief that no curer of hams superior to Mr Robert M'Harg of Dumfries exists in the kingdom.

For the best Boar, large breed, not under twelve months, and not exceeding four years old—the premium of five sovereigns, to No. 2, belonging to Robert Graham, Hetherside, Cumberland.

For the second best ditto—the premium of two sovereigns, to No. 3, belonging to Robert James, Chalkside, Cumberland.

For the best Boar, small breed—the premium of five sovereigns, to No. 6, belonging to M. C. Maxwell of Terregles, Kirkcudbright.

For the second best ditto—the premium of five sovereigns, to No. 8, belonging to James Wilkin, Tinwald Downs, Dumfriesshire.

For the best Breeding Sow, large breed, not under twelve months, and not exceeding

four years old—the premium of five sovereigns, to No. 2, belonging to Robert Hewetson, Auchenbenzie, Dumfriesshire.

For the second best ditto—the premium of two sovereigns, to No. 3, belonging to Walter Hewetson, Kirkbean, Dumfriesshire.

For the best Breeding Sow, small breed—the premium of four sovereigns, to No. 5, belonging to Robert Gibson, Braehead, Dumfriesshire.

For the second best ditto—the premium of two sovereigns, to No. 8, belonging to Robert James, Chalkside.

For the best two Pigs, not exceeding forty weeks old—the premium of three sovereigns, to No. 4, belonging to John Mackenzie, Barnhill, Dumfriesshire.

VIII.—Poultry.

This was by far the most extensive and finest exhibition of this useful and indispensable class of stock on every farm that has yet taken place under the auspices of the Society. Galloway is famed for good poultry, and the specimens produced demonstrated that its fame has been deservedly acquired. The turkeys, we observed, were mostly all of black colour. We think if the white were tried it would not only produce a larger but a more delicate fleshed bird. The geese were not so broad and compact in the body as they should be, possessing apparently too much of the Irish blood. The white Aylesbury ducks exhibited by Mr Hope Johnstone were the largest and most beautiful birds of the kind ever exhibited in Scotland of their age, only seven months. There were also a couple of very fine large young ducks, of the common breed, belonging, we believe, to David Wright, Barnsoul Mill, Irongray, which had been erroneously entered by one of his people at seven months old, whereas, as we were informed, being late birds, they were only four months old. Of the fowls, the Dorking seems to take the lead. In the Queen's poultry-yard at Windsor we have seen some fine specimens of fowls, new to this country, named the Cochin China, and the cross with them and the Dorking produces magnificent birds, the young pullets weighing as much as 10 lbs. a piece, and their eggs, the colour of the shell being warm brown, are represented to possess the richest flavour. We trust that this portion of the Society's exhibition, which is of growing interest, will receive marked attention in every part of the country.

For the best couple of Turkeys, of any breed—the premium of two sovereigns, to No. 6, belonging to J. J. Hope Johnstone of Annandale, M.P., Dumfriesshire.

For the second best ditto—the premium of one sovereign, to No. 7, belonging to William Scot of Craigmuie, Kirkcudbright.

For the best couple of Fowls, of the Dorking Breed—the premium of one sovereign, to No. 9, belonging to J. J. Hope Johnstone.

For the second best ditto—the premium of half a sovereign, to No. 3, belonging to the Countess of Selkirk, St Mary's Isle, Kirkcudbright.

For the best couple of any other Fowls, of pure breed—the premium of one sovereign, to No. 1, belonging to Mrs Stewart, Southwick, Kirkcudbright.

For the second best ditto—the premium of half a sovereign, to No. 2, belonging to Robert Thomson, Annfield Pottery, Glasgow.

For the best couple of Ducks, of any breed—the premium of one sovereign, to No. 3, belonging to J. J. Hope Johnstone.

For the second best ditto—the premium of half a sovereign, to No. 1, belonging to the Countess of Selkirk.

For the best couple of Geese, of any breed—the premium of one sovereign, to No. 4, belonging to Mary Mackenzie, Barnhill, Dumfriesshire.

For the second best ditto—the premium of half a sovereign, to No. 5, belonging to Andrew Thomson, Limekilns, Annan.

For the best specimen of Poultry of any other description—the premium of one sovereign, to No. 5, belonging to Mr Robert Osborne, Dalscone, Dumfriesshire.

IX.—Extra Stock, Seeds, Roots, and Plants.

Cattle.

The Silver Medal was awarded by the Directors to each of the following exhibitors in this class, namely:—To Mark S. Stewart of Southwick, near Dumfries, for his Short-horn Bull, *Fitzmaurice.* To the Duke of Buccleuch, for two Short-horn Oxen. To W. T. Carruthers of Dormont, for two Short-horn Cows, one aged eight the other four years. To Hugh Corrie, Newtonaird, near Dumfries, for a fine specimen of an Angus Bull. To Robert Osborne, Dalscone, near Dumfries, for two Ayrshire Heifers, aged respectively one year two months, and one year four months, bred by the exhibitor. To Alexander Kirkpatrick, Milnehead, for an Ayrshire Heifer in Calf, aged three years five months.

Horses.

The judges commended the three-year old Draught Filly belonging to Colonel M'Douall of Logan; as also the yearling Draught Colt, belonging to Robert Irving, Langdyke, near Annan. It was the cause of an expression of regret that this colt had been cut.

Sheep.

The Silver Medal was awarded by the Directors to Robert Threshie of Barnbarroch, near Dumfries, for six Gimmers of the Southdown breed; to Adam Blacklock, Upper Minnygate, near Moffat, for five Black-faced Tup Lambs; and James Milligan of Hayfield, near Thornhill, Dumfriesshire, for ten Blackfaced Ewe Lambs. The judges also commended the Leicester Dinmonts of Thomas Watson, Esperston, near Fushiebridge, Mid-Lothian; the ten Cheviot Ewe Lambs of Thomas Little, Pennyland, near Dumfries; and the four Wethers, cross between the Leicester Tup and Cheviot Ewe, of William Wright, Bengal, Lockerby, Dumfriesshire.

Swine.

The judges highly commended a sow of the small breed, belonging to Hope Hunter, Craighead, near Abington, Lanarkshire.

Roots, Seeds, and Plants.

The Silver Medal was awarded by the Directors to Thomas Laurie, Terreglestown, near Dumfries, for a specimen of Chiddam Wheat; to Thomas Biggar, King's Grange, Castle Douglas, Dumfriesshire, for Perennial Rye-Grass Seed, of fine quality, weighing 31½ lbs. per bushel; to Francis Wood, Jardington, near Dumfries for Seedling Potatoes, raised from the seed of the Highland Early variety; and to George Scott Elliot, Woodslee, near Cannobie, Dumfriesshire, for Hybrid Turnips, Potatoes, Mangel-wurzel, and Carrots, all of which were well deserving of notice.

X.—Pedigrees.

The following are the pedigrees of the Short-horn Bulls, Cows, and Heifers, in the competing classes, as communicated by the exhibitors:—

Of Bulls calved after 1*st January* 1841.

Mr Carruthers of Dormont's *The Grey*—got by Constitution, (3,476;) bred by Mr Fawkes; dam Lilla Grey, by Archibald, (1,652;) g. d. by Kirkharle, (2,178;) g. g. d.

by Duke of Wellington, (2,311 ;) g. g. g. d. by Yarborough, (705 ;) g. g. g. g. d. by Traveller, (655 ;) g. g. g. g. g. d. by Favourite, (252 ;) g. g. g. g. g. g. d. by Bolingbroke, (86.)

Mr Geekie's *Strathmore*—by the Baron, (3,095 ;) dam Diana, by Monarch, (4,495 ; g. d. Mayflower, by Invalid, (4,070 ;) g. g. d. Rosebud, by St Leger, (1,420 ;) g. g. g. d. by Comus, (3,455 ;) g. g. g. g. d. by Denton, (198 ;) g. g. g. g. g. d. by Henry, (301.)

Mr Charles W. Harvey's *Walton*—sire Locomotive, (4,242 ;) dam Olive Leaf, by Belvidere, (1,706 ;) g. d. Lady Barrington, by a son of Mr Mason's Herdsman, (304 ; g. g. d. Young Alicia, by Wonderful, (700 ;) g. g. g. d. Old Alicia, by Alfred, (23 ; g. g. g. g. d. by Young Favourite, a son of Mr Charles Colling's Favourite, (252.)

Mr Jobson's *Lilyson*, (6,131)—got by Mr Bates' 2d Duke of Northumberland (3,646 ;) dam Lily of the Valley, by Mr Crofton's Reformer, (or by a son of Reformer, (2,507 ;) g. d. Bellflower, by Sutton, (1485 ;) g. g. d. Rolla, bred by General Simpson, by Mr Charles Colling's North Star, (458.)

Mr Moreton's Bull—got by Gainford, (2,044 ;) dam by Olivas, (4,608.)

Mr Paterson's *Brutus*—got by Sir Charles Tempest, by Dash ; dam Moss Rose, by C. Ellinton's bull ; g. d. by Young Culling, (1843 ;) g. g. d. by Mr Wilkinson's red bull, (2,838.)

Mr Stewart of Southwick's *Howard*, (6,085)—got by Burlington, (3,245 ;) d. Victoria, by Shedlaw, (2,615 ;) g. d. by Commodore, (3,447 ;) g. g. d. by George ; g. g. g. d. by Letham, (364) ; g. g. g. g. d. by Simon, (5,133.)

Mr Tod's *Prince Albert*—by Don John, a son of Northumberland ; dam by Pedestrian, bred by Captain Barclay ; g. d. by Edrom ; g. g. d. by Leopold ; g. g. g. d. by Mason's Whiteworth ; g. g. g. g. d. by Yorkshireman, by Minor ; g. g. g. g. g. d. by Maynard's Eryeholm.

Mr Unthank, Netherscales' Bull—got by Mango, (4,359 ;) dam Venus, by Cripple, (1887 ;) g. d. by Young Rockingham, (2,549 ;) g. g. d. by Wellington, (2,824 ;) g. g. g. d. by Major, (2,255 ;) g. g. g. g. d. by Northumberland, (464 ;) g. g. g. g. g. d. by Styford, (629 ;) g. g. g. g. g. g. d. by Bolingbroke, (86.)

Of Bull Stirks calved after 1st January 1844.

Mr Carruther's *Lieutenant*—got by Milton ; d. Tuberose, by Constitution, (3,476 ;) g. d. Red Rose, by Snip, (2,604 ;) g. g. d. Rose, by Burley, (1766 ;) g. g. g. d. Young Anna, by Isaac, (1129 ;) g. g. g. g. d. Anna, by Pilot, (496 ;) g. g. g. g. g. d. Ariadne, by Albion, (14 ;) g g. g. g. g. g. g. d. Bright Eyes, by the same bull, (359 ;) g. g. g. g. g. g. d. by Shipton, (587 ;) g. g. g. g. g. g. g. g. d. by son of Suwarrow, (636 ;) g. g. g. g. g. g. g. g. g. d. by son of twin brother to Ben ; g. g. g. g. g. g. g. g. g. g. g. d. by twin brother to Ben, (660.)

Mr Hill's *Lord Mayor*—got by Eden, (3,689 ;) dam Moss Rose, by Defiance, son of Magog, (2,247 ;) g. d. Mayflower, by Styford ; g. g. d. Lively, by Cattrick ; g. g. g. d. bred by Mr Chalmers, Greta Bridge, got by Robert Colling's bull.

Mr Lyon of Kirkmichael's bull stirk—out of Strawberry, by a son of Duchess.

Mr Stewart's 2d *Fitzmaurice*—got by Fitzmaurice, (3,807 ;) dam Victoria, by Shedlaw, (2,615 ;) g. d. by Commodore, (3,447 ;) g. g. d. by George ; g. g. g. d. by Letham, (364 ;) g. g. g. g. d. by Simon, (5,133.)

Mr Tod's bull—got by Young Thorpe out of Young Sally Derby.

Mr Wetherell's *Emperor*—got by Lictor, (6,128 ;) dam Blossom, by Gracchus, (3,917 ;) g. d. Spring Flower, by Ganthorpe, (2,049,) &c.

Of Cows calved prior to 1st January 1843.

Mr Carruthers' *Tulip*—got by Wellington, own brother to Sir Richard, (5,175 ;) dam Red Rose, by Sir Richard, (5,175 ;) g. d. by Priam, (2,452.)

Mr Carruthers' *Rachel*—got by Sir Thomas, (4 ;) dam Ruby, by Sultan Selim, (2,710 ;) g. d. by son of Satellite, (1420 ;) g. g. d. from the stock of Mr Smith of Shedlaw.

Mr Carruthers' *Lady Sale*—got by Constitution, (3,476 ;) bred by Mr Fawkes ; dam Lady, by Thornton.

Mr Lyon's *Strawberry*—out of Strawberry, by Archibald, property of Mr Grey, Millfieldhill, sire Major, by Mr Chrisp's Magnum Bonum.

Mr Rome's Cow—got by Sir William, (5,202 ;) dam by Spectator, (2,680 ;) g. d. by Fitz Remus, (2,025 ;) g. g. d. by Whitworth, (695.)

Mr Stewart's *Red Rose*—got by Adjutant, (2,924 ;) dam Louisa, by Belshazzar, (1703 ;) g. d. by Noble Henry, (2,374 ;) g. g. d. by a son of Symmetry, (641.)

Of Heifers calved after 1st *January* 1843.

Mr Carruthers' *Violet*—got by Forester, (3,825 ;) dam Mary, by son of Flutham, (2,028 ;) g. d. from the stock of Mr Whitaker of Granholm.

Mr Carruthers' *Primrose*—got by Auld Robin Gray, No. 5, dam Red Rose, by Scrip, (2,604 ;) g. d. Rose, by Burley, (1766.)

Mr Carruthers' *Butterfly*—got by Raspberry, (4,875 ;) dam Daisy, by Wellington, own brother to Sir Richard, (5,175 ;) g. d. Lofty, by Flutham, (2,028 ;) g. g. d. by Admiral, (5 ;) g. g. g. d. by young Denton, (964 ;) g. g. g. g. d. by young Albion, (15.)

Mr Lyon's Heifer, out of Strawberry, by a son of Duchess.

Mr Lyon's Heifer, out of Liliard, by a son of Duchess, Liliard out of Red Rose, by a g. g. s. of Comet.

Mr Mackenzie's Heifer, got by Playfellow, (6,297 ;) dam by Tryo, g. d. by Memnon, (4,452 ;) g. g. d. by Wellington, (231 ;) g. g. g. d. by a bull from the stock of Mr Mason. Tyro by Maximus, dam by Monarch, (4,494,) &c.

Mr Stewart's *Jessie the 4th*—got by Southwick, (5,282 ;) dam Jessie, got by Shedlaw, (2,615;) by Commodore, (3,447 ;) g. g. d. by Grimaldi, *alias* Lowther, (364 ;) g. g. g. d. Simon, (5,133.)

Mr Stewart's *Snowdrop*—got by Southwick, (5,282 ;) dam Snowdrop, by Lottery, (2,226 ;) g. d. Gainford, by Thorp, (2,757 ;) dam a cow of Mr Lawson of Doepark, by a bull of Mr Hutchinson of Egglestone.

Mr Syme's *Helen*—got by Echo, dam by young Emperor, (3,717 ;) g. d. by a son of Wellington, (1574 ;) g. g. d. by Traveller, (655 ;) Echo got by General the 2d, (3,870 ;) by Gainford, (2,044 ;) dam young Catherine, by Sir William, g. d. Catherine, by Emperor, (1974 ;) Sir William, by Mr Studholme's Maximus, dam Emma, by Monarch, (4,495.)

Mr Trotter Bishop Middleham's Heifer, got by Duke of Northumberland the 4th, dam by Magnum Bonum.

Of Heifers calved after 1st *January* 1844.

Mr Carruthers' *Lalla Rookh*—got by Valentine, dam Tulip, by Wellington, own brother to Sir Richard, (5,175 ;) g. d. Red Rose, by Sir Richard, (5,175 ;) g. g. d. by Priam, (2,452.)

Mr Carruthers' *Rose Bud*—got by Auld Robin Gray, dam Red Rose, by Snip, g. d. Rose, by Burley, (1766,) &c. (See yearling bull, *Lieutenant's* pedigree.)

Mr Carruthers' *Colina*—got by Auld Robin Gray, No. 5 ; dam Rebecca, by Dormont, No. 2 ; g. d. Ruby, by Sultan Selim, (2,710 ;) g. g. d. by son of Satellite, (1420 ;) g. g. g. d. from the stock of Mr Smith of Shedlaw.

Mr Carruthers' *Blanche*—got by Auld Robin Gray, No. 5 ; dam Whiteson, by Mr Chrisp's bull, g. d. Rose, bred by Mr R. Booth, by Burley, (1766 ;) g. g. d. Young Anna, by Isaac, (1129 ;) g. g. g. d. Anna, by Pilot, (496 ;) g. g. g. g. d. Ariadne, by Albion, (14 ;) g. g. g. g. g. d. Bright Eyes, by the same bull, (359 ;) g. g. g. g. g. g. d. by Skipton, (587 ;) g. g. g. g. g. g. g. d. by a son of Suwarrow, (636 ;) g. g. g. g. g. g. g. g. d. by a son of twin brother to Ben, (666 ;) g. g. g. g. g. g. g. g. g. d. by twin brother to Ben, (660.)

Mr Carruthers' *Gowan*—got by Auld Robin Gray, No. 5 ; dam Buttercup, by Dormont, No. 2 ; g. d. Betty, by Sultan, g. g. d. Betty, bred by Mr Wilson of Edington Mains, Berwickshire.

Mr Carruthers' *Robina*—got by Auld Robin Gray, No. 5 ; dam Rachel, by Sir Thomas, No. 4 ; g. d. Ruby, by Sultan Selim, (2,710 ;) g. g. d. by son of Satellite, (1420 ;) g. g. g. d. from the stock of Mr Smith of Shedlaw.

Mr Milne's *Bessy Bell*—got by Ethelred, (5,990 ;) dam Amelia, by Gainford, (2,044 ;) g. d. Adelaide, own sister to Comet, (1854 ;) by Emperor, (1974 ;) g. g. d. Gaudy, by Monarch, (2,326 ;) g. g. g. d. Shaftoe's Gaudy by Cato, (119 ;) g. g. g. g. d. by Whitworth, (695.)

Mr Milne's *Mary Gray*—got by Ethelred, (5,990;) dam by Bachelor, (1666;) g. d.—a cow of Mr Chrisp of Doddington.

Mr Stewart's *Red Rose the 2d*—by Southwick, (5,282;) dam Red Rose, by Adjutant, (2,924;) g. d. Louisa, by Belshazzar, (1703;) g. g. d. by Noble Henry, (2,374;) g. g. g. d. by a son of Symmetry, (641.)

Mr Stewart's *Miss Gaze*—got by Howard, (6,085;) dam Modesty, (1026;) g. d. Tulip, 1026, by Campden, (1776;) g. g. d. by Noble Henry, (2,374;) g. g. g. d. by young Sir Alexander.

Mr Trotter's Heifer—got by Cleveland Lord the 2d, dam by Velocipede.

Mr Trotter's Heifer—got by Duke of Northumberland the 4th, dam by Eclipse.

Mr Unthank's Heifer—got by Eden, (3,689;) dam Venus, by Cripple, (1887.)

Mr Unthank's Heifer—got by his Royal Highness, (4,039;) dam by Gainford, (2,044,) g. d.; Venus, by Cripple, (1887,) &c.

Besides the exhibition in the Show-yard, other matters occupied the attention of the many gentlemen assembled during the three days. On Tuesday morning was a public breakfast in the Assembly Room, under the auspices of the Agricultural Chemistry Association of Scotland, which was presided over by Sir William Jardine, Bart. of Applegarth, immediately after which a discussion took place on various topics connected with scientific agriculture, which had been previously announced by the Association. In the afternoon the Committee dinner took place in the Assembly Room, when the Duke of Buccleuch occupied the chair, after which several of the company expressed their opinion of the very alarming state of the potato crop; and, in order that a searching investigation might be instituted into the cause or causes of so mysterious a calamity, a subscription was instantly proposed and carried into effect, to enable the Chemistry Association, with the assistance of men of science, to conduct the investigation. In the evening of the same day, a ball was got up in the Old Assembly Room. In the afternoon of Wednesday, after the general show, the great dinner took place in the Pavilion, erected beside the Assembly Rooms, under the presidency of the noble President of the Society, the Duke of Montrose. On Thursday morning another breakfast was given in the Assembly Room under the direction of the Agricultural Chemistry Association, and presided over by the Duke of Buccleuch. Several agriculturists made critical remarks on the treatment given by the farmers of Galloway to their young stock, and much information was afforded on the value of oil-cake as food for stock. In the afternoon of the same day an examination was held in the Assembly Room under the direction of the Committee for encouraging the education of agricultural chemistry in the parochial schools of Scotland, and the chair at which was occupied by the Marquis of Queensberry. Twenty-five scholars, from eight schools situated within a limited distance around the district of the show, were examined, first, on general education, in order to shew that the teaching of Agricultural Chemistry had not interfered with the ordinary avocations of the schools, and then

on agricultural chemistry, as set forth in Professor Johnston's Catechism on that subject. The proficiency which the boys exhibited, considering the short time they had devoted their attention to this latter subject, seemed to make a favourable impression on the meeting; and, as an encouragement to all the scholars, prizes, consisting of books, were distributed to a few of them from each school, who were pronounced by their masters, then present, to have best understood the subject in the course of tuition.

THE FARMERS' NOTE-BOOK.—NO. X.

How to Raise Good Seed Potatoes. By Mr ALEXANDER TOD, Easter Road, Edinburgh.—It is a well ascertained fact, that potatoes grown on highly cultivated land for a number of years, without change of seed, become weaker each successive year, and, if continued, would probably become at last quite unproductive; hence the necessity and advantage of change of seed from moss-land, or rather land recently brought into cultivation, and new to the growth of the potato. Farmers in districts long cultivated, proceeding on this principle for more than twenty years, required only to get a few bolls of potatoes grown on such land for seed, with which to raise on their own farms seed for the succeeding year; and from the then comparatively small quantity required there was no difficulty in procuring the necessary change. Now, however, it is very different—farmers have to bring their whole seed each year from such land, and the demand for it is, therefore, now so much increased, and the growing of it has become so profitable, that instead of being raised on new land, it is produced where the soil, by the progress of improvement in husbandry, has fast become as highly cultivated as early districts; and it must therefore be obvious to the practical farmer, that potatoes grown on such soil, which, though new twenty years ago, being not so now, will be generally deteriorated as seed, and more fit as an article of food. This circumstance, I consider, satisfactorily explains the cause of the failure in one field and the success in another, as plants, from such seed as has had its reproductive powers weakened by being repeatedly grown on improved land, are more liable to injury during all the stages of its growth than those from seed grown on really new land. Farther, I think this circumstance, considered in connexion with the state of the weather throughout this season, may explain the recent more general failure. The continued damp dull weather during a large portion of summer was succeeded by clear sunshine and heat, and shortly after by cold and continued rains, all which, acting alternately on the refined and therefore weak seed, mate-

rially affected the functions of the *stem*, and brought on premature ripeness in the tuber, which was immediately followed by disease or decay; for it is known that in those fields where the stem had strength to withstand the sudden and trying changes of the weather, and remained green and healthy till the usual period of lifting, the crop was comparatively uninjured. The weakness of the seed, however, is, I think, to be attributed not so much to being raised on too highly cultivated land, as to the erroneous manner of raising it. It is usual to plant potatoes four or five inches deep, and earth up the plants as they grow, to prevent the tubers being exposed to light and air. This process certainly improves the potato as an article of food, but, according to my experience, it weakens its productive powers too much to continue its species vigorously; and plants from seeds so grown are very susceptible of injury in unfavourable seasons or soils.

The remedy I venture to suggest is simple and practical, and within the reach of almost every farmer, and of such a character that it may be easily tried to a greater or less extent, according to circumstances. I propose that a portion of land most suitable to the raising of seed potatoes should be selected, and if it requires manure, let it be applied, and ploughed in *during the autumn or winter months*. In the spring, let the ground be wrought into a friable condition, and plant the seed the depth of *two* inches, but not more. During the summer, let the ground be kept loose and free of weeds, but do not earth up the plants, and in autumn lift the crop as soon as the shaw or stem begins to lose its greenness. By this method the crop will be as large as by the ordinary one; but, what is of more importance, the germinating powers of the potato will be found greatly improved and invigorated; for the greater number of the potatoes, having grown above ground, will have the advantage of the light and air, to form and strengthen the "buds" or "eyes," and, therefore, will be much hardier, and not so easily injured by either rain or frost as those grown in the ordinary way. This plan approximates in some respects to the state in which all tuberous plants grow naturally, and in questions of this kind it is both usual and wise to inquire how nature continues to reproduce plants or roots. On inquiry, we will find that, in natural plants, tubers are not buried four or five inches deep, and then have two or three inches more earth drawn over them as they grow; this is the work of *art*, and quite necessary in the case of the potato to make it fit for food, but highly injurious to it for seed, which I will farther prove by the following account of my own experience:—

Before I adopted the above method, I had, for several years, failures in my crops of early potatoes, more especially in the ash-leaf kidney and the Adelphi early; but, observing that *such potatoes as were accidentally grown above ground*, exposed to the

light and air, had well-formed "buds" or "eyes," which were strong and vigorous, I resolved to adopt the said method of growing my seed, and have done so for the last four years, and the result is, that my crops are considerably larger, and have no blanks.

Experiments with Manures on Potatoes and Turnips. By Lord Blantyre. (Communicated to the Philosophical Society of Glasgow by Dr R. D. Thomson.)

Experiment I.—On Potatoes—Cow Park of Porton Farm—Soil poor and light—had been subsoiled previous autumn, after being drained and ploughed for oats from old grass in 1842. One drill, each plot for experiment with each different rate of manure being about one-thirtieth of an acre.

	Bolls.	Pecks.
No. 1.—Dung at the rate of 30 tons per acre,	47	10 per acre.
2.—Nothing,	10	2
3.—3 cwt. Guano per acre,	21	1
4.—4 cwt.	25	12
5.—6½ cwt.	34	6
6.—7½ cwt.	31	4
7.—8 cwt.	34	6
8.—Dung at the rate of 30 tons per acre,	43	12

The boll is the Renfrewshire boll of 5 cwt. The wheat of this year (1844) appears inferior on the portion of the field where the above experiments with guano were tried.

Experiment II.—On Yellow Turnips—South-west field of Porton—Soil light. This field was not in very poor order, from having been in potatoes, dunged in 1841, wheat and barley in 1842. The other parts of the field not experimented on were dressed with bones, 30 bushels per acre, with 5 tons of ash dung. The crop was good.

	Tons.	Cwt.	Qrs.	
No. 1.—Bones and Dung as above, (30 bushels bones, 5 tons dung,) gave	23	17	0	per acre.
2.—3 cwt. guano,	26	2	2	—
3.—4 cwt. —	27	6	2	—
4.—5 cwt. —	28	16	2	—
5.—6 cwt. —	29	8	0	—
6.—7 cwt. —	31	9	0	—
7.—8 cwt. —	27	6	2	—
8.—9 cwt. —	28	16	2	—
9.—10 cwt. —	31	0	0	—
10.—Calcined Bones, 30 bush. per acre,	25	8	0	—
11. — 45 bush. per acre,	24	12	0	—
12.—Animal Charcoal, 30 bush. per acre,	25	0	0	—
13 — 45 bush. per acre,	25	8	0	—

The calcined bones were the riddlings of bones used in a china manufactory. The animal charcoal was got from some of the sugar refiners, called exhausted animal charcoal.—*From Proceedings of the Philosophical Society of Glasgow*, 1844-45.

British Oxen. By JAMES H. FENNELL.—The particular breeds of horned cattle may be readily distinguished by certain characteristics. Thus the Ayrshire cattle, found in many parts of Scotland and England, have small size, fine bone, much flesh, good symmetry, thin and loose skin, fine short silky hair, light-red colour, sometimes red and white, generally a black muzzle, short and fine horns, bent upwards and tipped with black; the Durham or short-horned breed possess large size, good and well-shaped bone, and much flesh, thin skin, fine short moss-like hair, red and white colour, sometimes self-red, and short, fine, crumpled horns. The Devonshire cattle, now kept in almost every county in England, particularly in some parts of Yorkshire, have good size, fine bone, and short fleshy carcass, thin skin, very silky when handled; colour generally red, with a light dun muzzle and ring round the eye; horns of medium length, generally growing outwards and rather inclining upwards. The Galloway cattle, found not only in that district of Scotland, but also in Norfolk, and sparingly in North Lancashire, are of large size, strong bone, well-shaped, rather thick skin, and long hair, colour black and brindled, no horns. The Guernsey cattle, met with in the Channel Islands and most of the private dairy farms of England, possess small size, fine bone, very thin skin, and short silky hair; light cream-colour, with black nose; short and crumpled horns, tipped with black. The Hereford cattle have large size, small bone, good shape, thin skin, fine hair, generally red colour, with white faces; horns of medium length, and rather inclining upwards. The Highland cattle, great numbers of which are brought to England and fattened, are of small size, well-shaped, have thick skin, long hair; colour black and brindled, sometimes dun black; horns of medium size, and bent upwards. The Irish breed, of which great numbers are brought to the markets of London, Manchester, and Liverpool, are of large size, strong bone, rough shape, thick skin, long hair; colour red, sometimes red and white, mixed or roaned; very long horns, bent upwards. The Jersey cattle, commonly called the Alderney, are of small size, fine bone, good shape, have very thin skin, fine short hair; cream-colour and dun, light dun muzzle; horns of medium length, fine, crumpled, and tipped with black. The Lancashire cattle, met with in Warwickshire, Leicestershire, and the northern parts of Lancashire, are of large size, strong bone, roughly made, thick skin, long and rough hair; colour various, but more commonly red and white; the horns long and thick, and commonly slouching. The Sussex cattle, found in that county and in Kent, are of good size, strong bone, well-shaped, thin skin, fine hair; colour red, with white faces; horns of medium length, and bent upwards. The Suffolk duns, met with

in that county and in Norfolk, are of medium size, stiffly made; have the skin of medium thickness, and shaggy hair; colour generally lightish dun; no horns. The Welsh cattle, now going out of use very fast in England, are of medium size, roughly made, have a thick skin, long shaggy hair, black colour, sometimes black and white; horns thick and long, in some of medium length.

Our various breeds of cattle are generally of hardy constitution. The Guernsey and Jersey cattle, though of very good constitution in their native islands, are delicate when brought to England, requiring shelter and careful attention.

All the species and breeds of oxen have only thirteen pairs of ribs, being a less number than in either the American or European bisons. Certain bones, found in the heart of all ruminating animals, except the horse and the stag, have been mentioned by some writers on comparative anatomy as accidental ossifications, found only in the adult animal, particularly in the male. This, however, is erroneous; for these bones are constant, and are found in the calf as invariably as in the adult, in both male and female. Professor Harrison thinks that the principal purpose of these bones is to protect the aorta from being endangered by the enormous muscularity of the left ventricle in these animals, to serve as a fixed point of action to muscular fibres, to prevent total closure of the ventricles, and to preserve the large sinuses from the powerful resilience of the aorta, to which object the very remarkable hard mass of fat found at the base of the heart in these animals is also assistant.

Oxen are greatly excited at scarlet, probably because, in a state of nature, they do not frequently meet with this colour, which is, therefore, strange to them, offering, too, a strong contrast with the surrounding cool tones. "A bull," says Barnaby Goodge, "will wax furious at the sight of any red thing; and the elephant and the lion cannot in nowise abide the sight of any white thing."* Mr R. D. Hay, in an interesting work upon colours, remarks that though red-yellow excites an agreeable cheerful sensation, bright yellow-red conveys an intolerably powerful impression, the active side being here in its highest energy.

It is, therefore, no wonder that impetuous, robust, uneducated men should be especially pleased with this colour. Among savage nations the inclination for it has been universally remarked, and when children, left to themselves, begin to use tints, they never spare vermillion and minium. In looking steadfastly at a perfectly yellow-red surface, the colour seems actually to penetrate the organ. It produces an extreme excitement, and still acts thus when somewhat darkened. A yellow-red cloth disturbs and enrages animals. I have known men of education to whom its effect was intolerable, if they chanced to see a person dressed in a scarlet cloak on a grey cloudy day."

* Booke of Husbandry, 1586, p. 127, b.

In all domestic animals the skin or hide forms one of the best means by which we can estimate their fattening properties. In the handling of oxen, if the hide be found soft and silky to the touch, it affords a proof of a tendency in the animal to take meat. A beast having a perfect touch will have a thick loose skin, floating, as it were, on a layer of soft fat yielding to the slightest pressure, and springing back towards the finger like a piece of soft thick chamois leather. Such a skin will be usually covered with an abundance of glossy hair feeling like a bed of moss, and hence is very appropriately termed a mossy skin. But a thick firm skin, which is generally covered by thick-set, hard, short hair, always handles hard, and indicates a bad feeder

The size to which cattle may be fattened is truly astonishing. Evelyn mentions the exhibition in London of an ox that was 17 feet from the end of the tail to the nose. At Bartholomew Fair in 1703, a great Lincolnshire ox was exhibited, measuring 12 feet from the rump to the face, and standing 19 hands high. The Bradwell ox, five years old, weighed 4,320 lbs., but it was so fat that it moved with difficulty. Mr T. Bond of the Lower Marsh, Lambeth, killed an ox whose total weight was 294 stone 3 lbs., with 40 stone 4 lbs of loose fat.* As a general mode of fattening oxen, it has been recommended to give them daily 2 lbs. of oil-cake, 5 lbs. of barley-meal, and 5 lbs. of hay-chaff, with a plentiful allowance of Swedes. By a composition for fattening cattle, manufactured by Mr Warnes of Walsingham, Norfolk, it is said that beef may be grown more cheaply than by any of the ordinary methods of feeding. Everybody knows that horses frequently pass some of their corn quite undigested: but this circumstance rarely happens with horned cattle; for, as they chew the cud, they can digest their food more effectually than those which do not—hence it is well known to graziers that one-third less will be enough for an ox than for a horse or an ass. According, however, to the experiments of De Dombassle and Biot this depends, at least in the case of roots, such as carrots and potatoes, upon boiling, so as to break the globular crust enveloping the nutrient matter† which the stomach cannot well effect.

Cattle are fond of the tender tops of furze, and in Shetland they shew a liking for the drift sea-weed on the beach. Linnæus says that cows are fond of the leaves of the bird cherry. Culpepper states that the leaves of the black alder "are good fodder for kine, to make them give more milk." Oxen will sometimes browse also on the leaves of the privet.

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* The Smithfield stone of 8 lbs. we presume is what is here referred to.—EDITOR.

† This matter, formerly named *amadine*, from its occurring in starch, M. Biot has termed *dextrine*, from its singular property of polarizing the rays of light towards the right.

A few acres of land cultivated with burnet, lucern, cabbage, turnips, and carrots, will supply the cow-keeper with a constant succession of green fodder for his cattle, and save him the expense of purchasing so much hay frequently at a high price, and greatly improve the flavour and increase the quantity of the milk. For the latter purpose, carrots are excellent in winter and early in the spring, but the butter made of the cream is generally a little higher coloured, being a deep yellow, though not worse in quality than that which is made when the cows feed in the summer months on sweet meadow grass. Some farmers give their cows malt-dust, especially in the winter—not the malt-kiln dust, which should be reserved for a top-dressing for corn, but the germ of the barley, which sprouts out while it is making into malt. After the malt has been dried on the kiln, and passed over a wire-screen, it falls through and separates from the malt. This malt-dust is of a very warm, dry, nourishing quality, causes the cows to drink freely, and yield a large quantity of excellent milk. The London milk would, probably, have a less watery flavour if the bad quality of grains given so largely to the cows were corrected by the constant addition of some malt-dust, which is found to improve the quality and flavour, and to augment the quantity of the milk. Each cow might have half a peck of it at her breakfast, and as much at the time of milking in the afternoon. From M. Boussingault's experiments on the feeding of cows with beetroot and potatoes, we learn that when either of these vegetables is given, to the exclusion of all other food, it does not fatten cattle nor increase the quantity of their milk. Two cows, which were fed exclusively on beetroot, fell off in 17 days nearly one-sixth, and their milk diminished from 8 to 9 litres per day to 5 litres; but when they were turned into pasture, they soon resumed their former weight, and yielded their former quantity of milk. They were next fed exclusively on potatoes, when they fell off still more in flesh than they did on beetroot, and the milk was reduced to two litres each per day; but on being placed on a mixed food of hay, chopped straw, beetroot, and potatoes, they regained their flesh, and yielded the same quantity of milk as at first.

It is a vulgar notion that the butter-cup, or crowfoot, abounding in meadows, is the cause of the butter having sometimes a bright yellow colour. Stillingfleet, in his *Observations on Grasses*, says he believes this to be a mistake; for he never could observe that any part of the plant was touched by cows or any other cattle. The proof that cows do not eat this acrid plant is strikingly visible in pastures, where, though all the grass is cropped to the very roots, numerous buttercups spring up, flower, and

shed their seeds in perfect security. They are indeed cut down, and made into hay, together with the rest of the weeds that usually infest every meadow, and in this state are eaten by the cattle, partly because they are incapable of separating them, and partly because, by drying, their acrimony is considerably subdued; but there can be no doubt of their place being much better supplied by any sort of real grass; for the excellence of a meadow consists in its producing as large a crop as possible of agreeable and nutritious herbage. Every buttercup, ought, therefore, to be extirpated, if practicable, along with the hemlock, kex, and other umbelliferous plants which are common in most fields. Linnæus, in his *Flora Lapponica*, p. 195, says that it was thought by some people that the marsh marigold made the butter yellow, but he denies that the cows ever touch that plant; yet he thinks that all kinds of pasture will not give that yellowness; then he observes that the best and yellowest butter that he knows, and which is preferred by the dealers in those parts to all other butter, was made where the cow-wheat grew in greater plenty than he ever saw it anywhere else. Mr Edwin Lees mentions an instance of seven cows having been poisoned by feeding upon the common meadow-saffron (*Colchicum autumnale*) in a field at Llanvihangel Pentre, South Wales, where it grew in great profusion. The farmer turned them into the meadow in the early spring, after a winter's feeding on hay, and being impatient for green food, they devoured this plant, and were all found dead next morning.* A valuable cow belonging to Mr William Morrow of Drumkerrin, near Armagh, died from being over-fed with frosted turnips, and, after being turned out, drinking copiously of cold water. Practical farmers and veterinarians assert that the essential oil of turpentine, in doses of two fluid ounces, or a common wine-glass full, administered in any mild fluid, acts as a specific in all such cases.

From the late Earl Spencer's observations on the period of gestation of seven hundred and sixty-four cows, it appears that it extends to two hundred and eighty-four days, not two hundred and seventy days, as formerly stated. As all high-bred animals have a natural tendency to degenerate, if not kept up by due intermixture of blood, it is very desirable to know in what manner the breed may not only be kept up to its standard, but also improved. Hitherto there has not been a sufficiently extended and carefully conducted series of experiments upon this subject; and, consequently, there are no positive data on record enabling us to determine, by comparative proximity with the legitimate

* The Naturalist, vol. i. p. 215.

zoological standard of the species, the probability of permanence in any particular breed.

In improving the form of cattle, it is necessary to select a well-formed cow, proportionally larger than the bull. Mr Cline, speaking upon anatomical principles, says that the base of the cone which forms the chest of a cow should be capacious, to afford the lungs sufficient room, and thereby promote the digestive powers of the animal, (though the Devonshire cattle are often deficient in their chest;) the hips and the twist should be broad, that the cavity for the fœtus may be sufficiently large; the breadth of the loins is always in proportion to that of the chest and the pelvis; the head should be small, and the length of the neck should be proportioned to the height of the animal, that it may collect its food with ease; the muscles and tendons should be large, to enable it to travel with greater facility; the bones, however, should not be coarse and large; a short-legged cow is preferable; the hair should be neither staring nor hard. A Gloucestershire rhyme describes a beautiful cow as being

> "Long in her sides, bright in her eyes,
> Short in her legs, thin in her thighs,
> Big in her ribs, wide in her pins,
> Full in her bosom, small in her shins,
> Long in her face, fine in her tail,
> And never deficient in filling her pail."

There is no month in the year equal to March for the production of calves, if we take the whole country into our calculation. As cows will propagate their species at any period of the year, it consequently depends in most cases upon the views of the farmer or grazier regarding the ultimate profits arising from cattle that we everywhere find some cows producing calves at one season of the year and some at another. Spring, however, is the principal season with breeders of stock in general, since calves produced early in spring commonly make out better, and are more profitable upon the whole (except such as are intended for the butcher) than those produced at any other season; whereas cows that calve several months before there is a supply of grass, scarcely ever yield so much milk during the succeeding summer as if the case had been otherwise; and hence the profits are lessened, to whatever purpose the milk may be converted. However, in large and populous towns and communities there is a constant demand for milk (and butter too) throughout the whole year, so that those persons who keep dairies, and supply their customers during the entire summer, are under the necessity of meeting the demand during the winter also; and hence some of their cows are always in full milk, that is, newly calved. Much, however, is now effected by the use of turnips, mangel-wurzel,

cabbages, carrots, and other succulent vegetables, in the way of causing cows to supply plenty of milk during the winter; but as it is a well ascertained fact that these vegetables cannot be cultivated but at a greater cost to the farmer than summer grass, this system is but little resorted to, except in situations where it always commands a remunerating price to the dairyman. In the principal districts where cheese is made in large quantities—as for instance, Cheshire, Derbyshire, Gloucestershire, Dorsetshire, &c.—the dairy farmers invariably contrive to have their cows calving sufficiently early in the season to enable them to commence cheese-making at the period there is enough of grass for the cows being turned out to pasture; and this process of cheese-making is regularly continued into the autumn; and in the early part of the winter the cows are no longer milked, as there exists a somewhat general opinion that cows that are allowed to go dry for three or four months before calving are apt to yield a greater quantity of milk during the next season. Besides, there is a saving in the expense of maintaining dry cows; for it is the general custom in the dairying districts to feed these cows upon straw and a small quantity of hay, or else a few turnips, after they no longer yield milk, until within a short period of their calving.

Dr Lyon Playfair, having selected a cow in good milking condition and at the time fed upon after-grass, ascertained the average amount of her milk for five days, and then proceeded to analyze it. In the first day it was observed that the milk of the evening contained 3.7 per cent. of butter, and of the following morning 5.6 per cent. The deficiency in the first observation is referred to the consumption of a greater portion of the butter or its constituents, from respiratory oxidation during the day, when the animal was in the field, than during the night, when it was at rest in the stall. When confined during the day, and fed with after-grass in a shed, the proportion of the butter rose to 5.1 per cent.; when fed with hay, the butter was 3.9 and 4.6 per cent.; when fed with portions of potatoes, hay, and bean flour, the butter was 6.7 and 4.9 per cent.; with hay and potatoes, 4.6 and 4.9 per cent. These facts, together with Boussingault's experiments, and the observations of dairymen in different localities, are opposed to Dumas' theory, that the butter in milk arises solely from the fat contained in the food; for it may reasonably be referred to the starch and other unazotised elements of the food, as maintained by Liebig. Potatoes are particularly favourable to the flow of milk and increase of butter, from the starch they contain; so is malt refuse. Porter and beer are also well known to be favourable to the production of butter, both in the milk of

woman and of the cow, although these fluids do not contain fat.* The quantity of caseine (cheese) in the milk was found by Dr Playfair to depend on the quantity of albumen in the food supplied on different days to the cow, and to the supposed destruction of the tissues by muscular exercise. Pease and beans are the food which yield most caseine. Pasturing in the open field is more favourable to the formation of caseine, while stall-feeding is more favourable to the formation of butter. The proportion of butter in the milk of woman is increased by rest and the diminution of the respiratory oxidation.

In the neighbourhood of towns and villages, where milk and other products of the cow are in demand for the market, a good food for rearing the young cattle may be supplied by dissolving pearl sago in boiling water. Eight quarts of this solution of pearl sago will cost only half the price of the same quantity of milk, and will prove even more nutritious than the latter. Oil-cake is an excellent food, along with turnips, to fatten calves, and the manure the cattle drop while upon this diet is very serviceable to the crops. An Ayrshire farmer, who uses annually about £120 worth of oil-cake for his cattle, assures us that disease scarcely ever occurs among his stock, although formerly he used to lose many of them, especially calves, which were frequently carried off by that fatal and malignant malady commonly called *black leg*, but which has entirely disappeared since he has commenced the use of oil-cake. Turnips, with a liberal allowance of oil-cake, are found conducive to early maturity. After a long course of experience, this grazier is of opinion that cows should calve during February; for, when born later than this month, the calves are, while in the farmer's possession, an eyesore, from their being so far behind their compeers in growth; but, if calved earlier than February, the cows are apt to fail in their secretion of milk before the grass can afford them a good bite.

Mr M'Bryde is of opinion that, to obtain the greatest amount of beef in the shortest time, the cattle should be tied up by the neck in stalls, and fed for six or eight weeks upon turnips, with oil-cake, bruised oats, beans, &c. Mr M'Culloch, factor at Logan, whose opinion is of great weight, thinks that ordinary sized cattle would feed fully as well tied up in properly ventilated houses; but that large cattle would do better in hammels, where they had a small space to move about, and which prevented their feet giving way. He observes that the cattle in the hammels

* On the farm of Mr Castle of Northbourne, in Kent, a cow, having got access to some fresh brewed strong ale left out to cool, drank so plentifully of it that she was shortly taken ill, and died in a few hours in a state of intoxication, although proper remedies were administered by a farrier who was called in.

consume more food than those stall-fed; but whether this extra food is expended in the production of motion or of fat he has not ascertained. From his experience, he prefers cutting turnips into slices of from one and a-half to two inches thick; and whilst this thickness prevents some little waste of the turnips from being too much reduced, it, at the same time, allows the cattle to masticate with ease, and to fill their stomachs with less trouble, and consequently there is less expenditure of the body. The system adopted at Logan Mains, in giving oil-cake to cattle, is to grow and preserve the seed, which is bruised and boiled along with equal proportions of bruised oats and bear, and of this mixture, from four to six pounds per day are given hot, after the cattle have been tied up about two months. The expense of this diet is amply repaid, and the manure is very much enriched. When oats are at a low price, a few pounds of them per day may be advantageously added to the turnips. If lumper potatoes can be had for not more than seven or eight shillings per boll, it might be profitable to feed cattle upon them.

Some French philosophers have found that, from the same food, a cow yields in milk twice as much food available to man as a feeding ox will yield in flesh and fat. M. Donné states that there is a striking anology between milk and blood, and says that he has injected milk into the veins of many animals without causing any injury. From lean cattle, poorly kept, milk is never known to be good. London milk is generally deficient in thick rich cream. The Durham cows yield a large quantity of milk, and numbers of them are, therefore, kept in London dairies and in the dairy-farms about Manchester. Milk of a rich quality, fit to supply good cream and butter, is generally yielded in small quantity, as in the case of the Galloway, Guernsey, Hereford, Highland, and Jersey cows. The cows used for the London milk market are mostly of a large size, with short horns, and are distinguished by the name of Holderness cattle—from a district so called in the East Riding of Yorkshire. It appears that the entire number of cows kept by the London cow-keepers amounts to 8,500—namely, 7,200 in Middlesex, 681 in Kent, and 619 in Surrey. Each cow, on the average, yields nine quarts per diem, or 3,285 quarts per annum; but deducting 285 quarts for suckling, casualties, &c., gives us a total of 6,375,000 gallons of pure milk to supply the consumption of London and its vicinity. But as the retail venders adulterate it with at least 120 per cent. of water, the total annual consumption of *what is called milk* amounts to 15,937,500 gallons. Each Londoner, on the average, consumes annually ten gallons, three quarts, and nearly two pints of milk. The price at which milk is sold to the retail venders varies from 1s. 8d. to 1s. 10d. for eight quarts; which, tak-

ing it at the medium of 1s. 9d., gives a total of £278,906, : 5s. for the wholesale price, and an annual expenditure, after the assist ance of the pump, of £697,265 : 12 : 6. According to the occupation abstract of the census of 1841, the number of persons employed in feeding cows and selling milk in London was 2,764. While the milking of cows is going on, the pans should be placed in boiling water. If the milk be strained into one of the hot pans, and covered with another hot pan, proceeding in like manner with the whole mess of milk, you will find that you will have double the quantity of good rich cream, and double the quantity of sweet and delicious butter. It has lately become very common, especially in large dairies, to keep milk in zinc bowls, which have been recommended for promoting the formation of a larger quantity of cream, owing to galvanic action; but the use of them has been attended with poisonous effects.

I could scarcely have believed, says Dr Elaines of Berlin, that zinc vessels could again have come into use for holding fluids used for alimentary purposes, as Vauquelin, forty years ago, proved that such were certain, after a short time, (when, the milk has become sour, and the pans themselves sour,) to hold a considerable portion of zinc (and salts of zinc) in solution. I have found by experience that a solution of sugar, which had stood only a few hours, in summer, in a zinc vessel, contained a considerable amount of zinc salts. Cream will separate more easily from milk kept for a short time in a zinc vessel; but as the milk will turn acid much sooner than a solution of sugar, it is the more to be apprehended that some zinc will be dissolved, and such milk will be the more noxious, as it is well known that even a small amount of zinc will cause violent spasmodic vomitings.

The coagulation of milk under the influence of a simple wet membrane is a remarkable phenomenon not easily explained. Berzelius tried a very curious experiment with a view of ascertaining the effect on the membrane itself. He took a bit of the lining of a calf's stomach, washed it clean, dried it as completely as possible, weighed it carefully, put it into eighteen hundred times its weight of milk, and heated the whole to 120 degrees Fahrenheit. After some little time, coagulation was complete. He then removed the membrane, washed, dried, and weighed it again; the loss amounted to rather more than one-seventeenth of the whole. According to this experiment, one part of the active matter dissolved from the membrane had coagulated about thirty thousand of milk.

The experiments of Professor Traill shew that the addition of some cold water facilitates the process of butter-making, especially when the cream is thick and the weather hot; that cream alone is more easily churned than a mixture of cream and milk; that butter produced from sweet cream has the finest flavour when fresh, and appears to keep longest without acquiring rancidity; but the butter-milk so obtained is poor and small in quantity; that the scalding of the cream, according to the Devonshire method, yields the largest quantity of butter, which, if intended

for immediate use, is agreeable to the palate and readily saleable; but, if intended to be salted, is most liable to acquire by keeping a rancid flavour. The process of scalding is troublesome, and the milk, after the removal of the cream, is poor, and often would be unsaleable from the taste it has acquired from the heating. It also appears that churning the milk and cream together, after they have become slightly acid, seems to be the most economical process on the whole; because it yields a large quantity of excellent butter, and the butter-milk is of good quality; and that the keeping of butter in a sound state depends on its being obtained as free from uncombined albumen or caseine and water as it can be, by means of washing and working the butter when taken from the churn.

By a newly invented block-tin milk-churn, now in use at Lisburn and other parts of Ireland, butter can be made in ten minutes at all seasons of the year. In salting or curing butter, it is preferable to use vessels made from timber which has been previously boiled four hours, to free it from the pyroligneous acid; or else made of the lime tree, the wood of which does not contain this acid. Butter will keep without salt if melted over a slow fire to expel all its watery particles. To remove the bad smell and disagreeable taste of rancid butter, and restore its sweetness, it is only necessary to beat it in a sufficient quantity of water, into which put fifteen drops of chloride of lime for every pound of butter. After having mixed it till all its parts are in contact with the water, it may be left in for an hour or two—afterwards withdrawn and washed anew in fresh water. The chloride of lime has nothing injurious in it, and, therefore, the number of drops may be increased if thought proper.

In all ages the skin of the ox has been turned to great use by man. The ancient Britains made their boats with osiers and covered them with the hides of bulls. Vessels of this kind are still in use on the Dee and Severn, and on the lakes of Ireland. The Irish call them *curach*, and the English *coracles*, from the British *corwgl*, which means a boat of that structure.*

Garnet, in his *Tour through The Highlands*, states that, during times of want and scarcity, the cows are brought into the huts to share the family's little stock of oatmeal, and are bled occasionally to afford nourishment to the children, the blood being mixed with their oatmeal and then boiled or made into cakes.

The hoofs and horns of a hundred head of cattle are daily consumed in Campsie Alum Works in the manufacture of that

* That these vessels were not suited for long voyages, but were only capable of short coasting excursions, is evident not only from their structure, but from the statement of Solinus, that the crew never ate during the time they were at sea. (Life of John Scott, Physician, &c.)

beautiful yellow salt, prussiate of potash, which Mr Macintosh introduced among the calico-printers, who use it extensively to produce very showy blues and greens. It is prepared by burning the hoofs and horns in iron pots, along with potash and a requisite quantity of iron. The residue, after this combustion, is laxiviated with water, and when the solution is sufficiently concentrated, the prussiate of potash crystallizes.

It would be well if some good cook, acquainted with a little chemistry, would make some experiments upon the cookery of bone, which might be made to yield many soups and other palatable and nutritious dishes. Professor Brande observes that—

Bone constitutes, upon an average, a fifth part of the weight of an animal, and one-third of the weight of bone may be reckoned as good substantial food. The weight of butcher's meat consumed in London annually is supposed to be 172,000,000 lbs., including 35,000,000 lbs. of bone, which would yield 11,000,000 lbs. of dry gelatine, or real nutritive matter, which, at present, is so far wasted as not to be applied to the direct support of human life. The bones of pork, game, poultry, and fish, not included in this statement, must also be of great amount. From all or any of these an excellent dry gelatine, or portable soup, might be prepared and sold for about 2s. per lb., equivalent to three or four times its weight of raw meat.

Ground-bones are employed as a manure for dry soils with the very best effect. Mr Huskisson, who estimated the real value of bones annually imported (principally from the Netherlands and Germany) for the purpose of being used as a manure, at £100,000, contended that it was not too much to suppose that an advance of between £100,000 and £200,000 expended on this manure, occasioned 500,000 aditional quarters of corn to be brought to market. When bones are intended for manure, they may be dissolved by pouring some sulphuric acid over the bone-heaps, keeping them turned until they are thoroughly in contact with the liquid.

Goldbeaters' skin is made of the finer integuments of cattle. Having offered these remarks on some of the characters, habits, and uses of cattle, I will, in conclusion, allude to a few of their diseases. Tubercular consumption, which is very prevalent among the cows which supply milk to the inhabitants of some large towns, is attributed by Sir James Clark to their being immured during part of every year in dairies, perfectly closed, and which being too small for the number of animals they contain, soon become filled with heated vitiated air, for the removal of which no contrivance is made. Recently there has prevailed in the dairies of London and its vicinity, a new disease, which chiefly attacks cattle in the hinder extremities, paralysing their limbs, and presenting many of the ordinary symptoms of pleuro-pneumonia. Mr James Dixon of White Moss farm, Cheshire, states that, until he adopted the treatment of bleeding his cows immediately on their being attacked with

the "new epidemic," he lost several; but none had died since he had put that measure into operation. Particular care and caution are required to keep a continual watch over the condition of the animals so as to mark the first change in them from health to disease; for the value of bleeding depends on its being performed at the very instant that the symptoms of the disorder make their appearance. The treatment of bleeding having been promptly resorted to, Professor Sewell recommends that the administration of the usual laxative medicines and external stimulants should be left to the judgment of the nearest practitioner. The Earl of Essex relates that the prevalent distemper having shewn itself in one of his yard stock, by an abundant discharge of saliva from the mouth, with sore and inflamed tongue and gums, great dulness, no appetite, confined bowels, and very hot horns, he ordered one-half pint of spirit of turpentine, with one pint of linseed oil, repeating the oil in twenty-four hours, and again repeating it according to the state of the evacuations. At the end of twenty-four hours more, the bowels not having been well moved, both the turpentine and oil were repeated. In two days the beast shewed symptoms of amendment, and in three or four took to his food again, and did perfectly well. His Lordship assures us that all the yard beasts and fattening beasts that had the distemper were treated in this manner with perfect success. Half a pint of turpentine is the smallest, and one pint the largest dose, during three or four days. But little food besides oatmeal was given.

*The Bee-keeper's Manual.**—Nothwithstanding the great accessions which, of late years, have been made to our knowledge of the natural history of the hive bee, and the improvements in its economical treatment which we have been thereby enabled to introduce, it is obvious that we are by no means, in this country, raising this interesting branch of rural economy to that degree of importance to which it seems entitled. There can be no doubt that this country is well adapted to bee-culture, especially in the varied character of its surface, abounding in water, woodlands, cultivated fields, and flowery uplands, interspersed with orchards and flower-gardens, and rearing in plenty nearly all the plants in which bees delight. The variability of the climate is perhaps the principal drawback, but even that is by no means so considerable as to form a material obstacle. Yet an apiary of any extent, and managed systematically as a regular source of income, is scarcely, if at all, to be found in this country. The only dis-

* The Bee-Keeper's Manual, founded on the experience, during many centuries, of the Apiarians in Poland. Dedicated to the Agriculturists of Great Britain. By Dobrogost Chylinski. London: Wm. S. Orr & Co., 1845.

coverable symptoms of bee-culture being known at all in Britain, consist of a few pitiable straw hives or skeps, straggling along a garden wall, capped with damp and mouldering turf, enveloped in rags in the winter, or shut up in little wooden hovels, "which," says Mr Dobrogost Chylinski, "have more the appearance of pestilential prison-houses than the comfortable abodes of a refined and busy population." We often hear it alleged as a reason for not cultivating bees more extensively, that they are extremely precarious, continually liable to some disaster or other, and their productiveness, therefore, not to be depended upon. But we are ourselves principally to blame for this, if we do not follow the best methods of treatment, and bestow that degree of care and attention which the occasion demands, and which is not greater than what we often willingly give to other matters, where the inducement is much less considerable.

Poland is perhaps the greatest honey-producing country in Europe. In the provinces of Podolia, Ukraine, and Volhynia, in particular, the cultivation of the honey-bee has long formed an object of national importance, and in these, bee-gardens are not only very numerous and extensive, but they are also common in other parts of the kingdom. There are cottages in Poland with very small portions of land attached to them, on which are to be seen as many as fifty hives; while there are farmers and landed proprietors who are in possession of from 100 to 10,000 hives! There are some farmers who collect annually more than 200 barrels of fine honey, each barrel weighing from 400 to 500 lbs., exclusive of the wax. A tenant is often in this way enabled to pay his rent and taxes, to defray other domestic expenses, and often to accumulate handsome dowaries for his daughters.

The object of the little work, the title of which we have given above, is to describe the method of managing bees as practised in Poland; and as there appears to be nothing to prevent it being followed in this country, we propose to notice, as briefly as possible, the leading features of the plan. It differs widely from that of all other countries; is less expensive and more profitable; less artificial, and agreeing better with the natural habits and economy of the bees; and, in Mr Chylinski's opinion, were the agriculturists of Great Britain to take advantage of the experience acquired during past centuries, by the most successful bee-keepers of Podolia, Ukraine, and Volhynia—and were they to begin by laying the foundation of their apiaries with only one hive, *whose colony must be stronger than four straw hives taken together*—in a few years Great Britain would add to her other honourable distinctions, the more ancient and once exclusive designation of "the land of milk and honey."

It is curious that many bee masters of Poland maintain that,

besides the three ordinarily recognised inmates of the hive, namely the queen, drones, and workers, there is a fourth class which they call *consorts*, and which are described as being smaller than the queen or drones, though somewhat larger and blacker than the workers, as destitute of stings, and contributing nothing to the general store. They compose the train which waits upon the mother, and are supposed to be males.

The Polish hive, at least in some modification of its form, has been long known in this country, and will be found figured in some of our works on bees. It stands from 3½ to 5 feet in height, of a circular shape, broadest at the bottom, perhaps about 20 inches in diameter, and narrowing gradually to the top, where the diameter may be about 8 inches. It is composed of well-seasoned boards 1½ inches thick, joined by means of wooden pegs; the top is covered by a round lid, and surmounted by a shallow clay pan of large size; and the hive is closely corded with a pretty thick rope from the top exactly to its middle. The entrance for the bees is a small triangular hole in front, at some distance from the base. Hives destined for winter stock or seed have a door about 18 inches long and 6 inches wide on the back side, opposite the entrance for the bees. In Lithuania, and other northern provinces of Poland, the hives are made of trunks of trees hollowed out; and such of the people as inhabit forests occasionally tie their hives near the top of a large tree, smearing a ring of tar mixed with sulphur round the tree, about two yards from the bottom, in order to prevent vermin creeping up and molesting the bees. In this situation they often remain for years, exposed to all the vicissitudes of the weather.

Almost every farm has an orchard sheltered from the northern winds by farm buildings, and generally a portion of land set apart for a bee-garden. The place chosen for the apiary is commonly a low dry position, in a valley at the foot of a hill, or on the borders of a forest, frequently a common surrounded by thick woodlands, planted for the purpose of sheltering the bee-garden from the high winds. The hives, judging from the figure of a bee-garden given in this work, are placed in regular rows at equal distances from each other, and present a very neat and orderly appearance. Commonly the turf is removed altogether from the surface, and the earth is kept clean and dry. It is considered necessary, at all events, that the spot selected for the hive should be quite free from turf for some distance around the base. The hive is placed with its front towards sunrise, so that the first dawn of the morning may fall upon the entrance. When an extensive bee-garden is established on the east side of a hill, the latter is generally cut into gradual steps, about 5 feet wide and 3 feet high. The ground prepared for the stand must

be strewed with clean dry sand, about 1 inch thick; and on this the hive is placed, without trestle, board, or any support whatever.

The first duty of the Polish bee-keeper in early spring, (the beginning of April,) is to remove the earth placed round the hive; he then places the hive upon the trestle, cuts out the wax combs emptied by the bees during the winter season, taking care to leave a sufficient quantity of them for the lodgings of the whole colony, and taking particular care not to touch the combs or cells filled with the young brood, eggs, or honey. The whole interior of the hive and its neighbourhood are carefully cleaned, and fresh sand strewed on the stand. The next day after this operation, he administers to every hive a tablespoonful of pure, clear honey, dissolved in hot water, and this must be done twice a-week for four weeks successively. The best time for supplying this food is after sunset.

Swarming commences in Poland about the middle of June. The utmost care is taken to prevent a thinly populated hive impoverishing itself by too frequent casting. And this they accomplish very efficiently, simply by raising the lid from the top of the hive, and *cutting out the royal cells*. The same method is adopted to prevent young hives casting maiden swarms. In large establishments sometimes more than fifty swarms are cast on the same day, and these are often found gathered together in one place. In such a case, the bee-keeper gathers as many as possible into one or more hives, and keeps them so crammed till the evening. He then spreads out some sheets of linen, on which he puts, in a single heap, all the bees he has gathered, and leaves them in that condition during the night. Next morning every swarm is found to have separated and assembled round its own queen.

The honey-harvest in Poland begins in the end of September. Having fixed on those hives he intends to keep as propagators or for winter stock, the bee-keeper cuts out the honey comb from only one-half of the hive, the other half he leaves for the bees to live upon during the winter. This operation is performed by means of a knife of peculiar construction, and access to the interior is obtained by the door in the hinder part of the hive. The hive is prepared against the rigours of winter by filling up all the cranies or slits with clay, pasting up the entrance so as to leave an opening fit for the passage of only a single bee, the bottom of the hive is surrounded with earth, above which are placed chips and dry moss; and the stand is again strewed with fine sand.

The construction of the Podolian hive is such as to withstand all the inclemency of the climate; the rope with which the hive is corded from its middle to its top withstands the cold and damp; the bare earth on which the hive stands evaporates a quantity of warmth proportionate to the degree of frost without, keeping the

necessary temperature; but the most important security is the *abundance of nourishment*, which also helps to withstand cold; and unless the bees are plentifully provided with it, no hive ever can save them from starvation; for hunger often destroys bees more certainly than frost.—P. 52.

Our author strongly recommends the cultivation of buck-wheat as one of the most useful plants for bees. He affirms that a single acre of it would furnish plenty of honey for the most populous parish.

We cannot follow him into the third part of his little work, in which he treats of the management of honey, wax, &c. In his country honey is extensively used, standing in some degree in the place of sugar. It is used to sweeten tea, coffee, and preserves, and a drink named krupnik, of which the inhabitants are very fond, is prepared from it. A still more common beverage is *miodomel*, which is as plentiful as beer in this country. As this drink is exceedingly agreeable, as well as an excellent stomachic, generally causing those who drink it to live to a great age, (so our author affirms,) we shall conclude our notice of this useful little bee-manual, by giving a recipe for manufacturing this elixir, premising that it has been obtained from the Prior of *Sokal*, a celebrated stronghold on the banks of the Bug, which was long resorted to by multitudes of pilgrims from great distances, whose homage was divided between a miraculous Holy Virgin, and this far-famed miodomel, the latter of which is profanely alleged to have had the best of it in this contest for popularity. To 24 gallons of water put 12 gallons of honey and 12 lbs. of hops, boil them together over a *very slow* fire, till the whole is reduced one-third. From the boiler empty it into a large tub or barrel, which must be deposited in a warm place during eight days, so as to undergo the process of fermentation; afterwards it must be filtered through a woollen filter into a barrel, and placed in a cellar for use.

*Zoology of the English Poets.**—The naturalist and the poet have often much in common; it is frequently the same sensibility to the beauties of nature, the same love of contemplating her productions, and drawing pleasure from their endlessly varied forms of fitness and beauty, that animates both the one and the other. The love of nature exists strongly in both; and it may often be but a slight difference in mental constitution—a trifling modification of idiosyncrasy—or even the accidental influence of external circumstances, which leads the one to the minute and elaborate examination of natural objects, and the other to dwell with delight on their more general aspects and relations. Many

* The Zoology of the English Poets, corrected by the Writings of Modern Naturalists. By Robert Hasell Newell, B.D., Rector of Little Hormead, Herts. London: Longman & Co. 1845.

departments of natural history, it is true, are far enough removed from the regions of poetry—and they are often rendered still more so by the manner in which they are cultivated. But there are none which, in some of their bearings, do not rise into those "regions mild, of calm and serene air," which are the chosen abodes of poetry; and if any of them fail to form a fitting theme for the muse, the defect will be found elsewhere than in the intrinsic merits of the subject. Great is the delight of the naturalist when he finds the favourite objects of his study worthily celebrated by his tuneful brethren, "married to immortal verse;" but this is a pleasure he does not often enjoy. For the descriptions and representations of natural objects, given by our poets, are very seldom accurate; they are generally disfigured by erroneous statements of matters of fact, false inferences, and unwarrantable notions. In fictitious poetry, it is true, we do not always expect truthful matter-of-fact delineations; but even in such a case, similies and illustrations derived from natural objects ought to be true to nature; while, in purely descriptive poetry, adherence to truth is indispensable. Here, as Mr Newell remarks, the very intention of the poet is to inform and instruct; to represent nature falsely, therefore, is to deceive the reader, to deprive him of the knowledge he expects, and to derogate from the honour due to the Author of nature. Poets, it may be said, are not always responsible for their inaccuracies; they took the subjects most suitable to their purpose, as they were generally known and believed at the time they wrote, and as they were defended by classical authority. It is proper, however, that these circumstances should be pointed out, because poets are early read, and hence the erroneous notions imbibed from them are deeply fixed and long retained. From the improved state of natural history, such mistakes are henceforth less likely to occur, and, when they do happen, will be easily corrected. As the science advances, Mr Newell remarks, a wider and more accurate acquaintance with its discoveries will prevent a trite repetition of the same images; objects will be viewed in new lights; new properties and qualities will be known; and the poets be thus enabled to spread through their works faithful descriptions in boundless variety, sublimity, and beauty.

To correct some zoological errors in English poetry by a comparison with the writings of modern naturalists is the design of Mr Newell's little volume. The author does not appear to be himself a practical naturalist, neither was it necessary that he should be so to perform the task in the circumscribed manner in which he has undertaken it. It is to be regretted, however, that his work is almost entirely a compilation, and that so little has

been given as the result of his own personal observation. It is to this that we must ascribe the extreme meagreness of the work ; more extensive reading would have enabled him to give a much more ample and satisfactory view of his subject. Meagre as it is, it is not always pertinent to the object in view: the long quotation from Hurdis, for example, on the coccinella, and that from Churchhill on the bee, are not adduced for the errors, but for the accuracy and beauty of their descriptions. And this leads us to remark, that the value and interest of such a volume to the zoologist would have been greatly enhanced had it contained extracts of some of the best pieces of poetry in reference to zoological subjects ; had it been the *Zoology of the Poets*, not only in its defects, but also in its merits and beauties. A due economy of paper and printing would have afforded the means of doing this almost without enlarging the size of the volume, which is redolent of what is, we believe, technically (whatever it may be on the score of elegance) denominated *fat* by the printers.

The errors to be found in a compilation are not in the highest degree chargeable to the compiler ; but they are so in a secondary degree, and he is responsible for the use he makes of the materials he derives from others. A want of familiarity with the literature of natural history has prevented our author employing the best materials that could be obtained ; and various inaccuracies are to be noticed, which are unseemly in one who has assumed the task of correcting others. For example, he states that the honey-bee is, of all social insects, the only one whose habits are not carnivorous ; now this is equally true of the humble-bees (*Bombi*) and numerous other kinds. It is elsewhere affirmed that the glow-worm is not the only luminous insect in our country, for there is a scolopendra which is luminous, and the luminous appearance on oyster-shells, in the dark, is said to be produced by those sorts of animalcula which have been discovered on them. Now, neither the scolopendra nor the animalcula in question can with any propriety be now regarded as insects. Similar to the inaccuracy noticed in Milton's Paradise Lost, where it is said *the female bee* "builds *her* waxen cells with honey stored," is an error the same author commits respecting the sex of the nightingale, when he says—

"And in shadiest covert hid, tunes *her* nocturnal note."

Why is this and many similar instances that we could mention omitted ?

But we must endeavour to find something in this scanty and unsatisfactory volume more expressly adapted to our agricultural readers. Let us turn, then, to the rook, respecting which, we suppose the grand question has not yet been definitively

settled, whether it be the farmer's friend or foe. Our author adopts the opinion that it is not prejudicial to our corn-fields; so that he has to refute the supposed error of those poets who take an opposite view, such as Bloomfield, who says, in his sadly prosaic verses—

> "But still unsafe the big swoln grain below,
> A favourite morsel with the rook and crow;
> From field to field the flock increasing goes,
> To level crops most formidable foes"

We have neither space nor inclination to enter into this vexed question at present; but may record it as the result of personal observation, that the rook often eats considerable quantities of corn in the autumn, and we have known instances in which there was every probability that entire fields of autumn-sown wheat would have been destroyed had the rooks not been carefully driven away. In one instance, where this precaution was not observed, almost the whole of the braird, after it had begun to appear at the surface, was rooted up; whether this was done for the purpose of digging up grubs and other kinds of animal food, was a matter of little consequence to the farmer, as the result was all but fatal to the crop.

Characteristics of 1845. By Mr Towers.—It will be impossible to bring forward, in an article which is written for the Number of January 1846, all the phenomena of its predecessor. We must, therefore, retrospect, and take in a few weeks of 1844; and, in point of fact, the character of the last extraordinary winter was fully established before the close of November. It will be equally curious and interesting to compare the meteorology of the two great divisions of Britain, and as the following remarks will be drawn from observations taken in Berkshire, one of the English southern counties, and essentially agricultural, our brethren to the north of the Tweed will perceive at a glance how two remote countries have been visited at the same periods of time.

There was no frost of moment, scarcely the slightest rain, till the evening of the 21st of November, but then, with a very high state of the barometer, which was maintained from the 14th till December 11th, the cold began to be severe. The wind blew, with little deviation, from some easterly point, to the end of the year. The current was not generally strong, but became very forcible on the 12th, 13th, and 19th of December. A more gloomy sunless period I never recollect. My Meteorological Diary registers the word "sun" four times only in the height of day throughout the course of the two months; and about the joyous "festive season" of Christmas, gloom and dense fogs pre-

vailed for several days. These fogs were equally felt at Paris, where a phenomenon of such unwonted occurrence created much surprise. The average maximum temperature of the thirty days, from November 22d to December 21st inclusive, was only 35.66°; of the lowest, during the nights 30°, or nearly 9° below that estimated in the published tables. The close of December became more mild, with a thaw and gentle rain on the 28th and 29th.

Previously to this severe weather the works of husbandry had proceeded favourably, with every prospect that the period could warrant. The state of the weather may be given in few words: The drought, like the sunless gloom, was almost undeviating—no rain or snow—and such was the state of the ground, that the thaw of five days' continuance after the 15th did not make the surface in any degree dirty.

The barometer, which had fallen below 30 inches on the 12th December, rose again to that mark on the 19th, and thence to 30 inches 27 cents., its maximum, on the 21st, continuing unusually high to the end of the month.

The new year commenced with the instrument at 30 inches 11 cents.—thermometer 35° minimum, 42° maximum; the wind soon veered westerly, and so continued with few deviations to south-east till the 21st; then, and then only, we had one perfect day, all its precursors of the month having been cloudy or hazy. We had rain on five or six days, but not in quantity to prove any compensation for the excessive aridity of 1844; the month also was nearly free from frost till the 28th day, though the mean temperature was low; then, however, the thermometer at sunrise indicated 2° (30° Fahr.) and fell to 25°, or 7° of frost, on the 30th and 31st, with snow on the 28th and 31st. Thus ended January, too mild, and inverting the seasons, inasmuch as December and February were far more severe, and the latter, succeeding to a month of comparative mildness, wherein the grass grew, and the meadows became green, did abundance of serious injury to the gardener. The old adage says,

"If grasse do growe in Janevere,
'Twill growe the worse for't all the yere."

And not in this instance only, but in several others, within the recollection of many readers, an unseasonable January, interposed between two severe months, has proved a sorrowful but too faithful indicator of an ungenial spring and perplexing summer.

February, in its details, claims, therefore, particular attention. It commenced with the wind at north by west, brilliant sunshine, and temperature, minimum 24°, maximum 33°, and at 10 P.M. 31°. During the following night, the wind veered to N. by E.,

but went back to a north-westerly point, where it remained till the 6th, the frost meliorating at nights, the days being mild and fine. But on the 7th, and thence onward to the 13th inclusive, the cold was very severe, its greatest intensity falling on the 12th, when the night self-regulating instrument had left its mark at 5° of Fahr., or 27° of actual frost. Not remote from me, a gardener reported his thermometer at zero. The rigour abated in some degree, but nothing could compensate for the damage sustained by the tenderer sorts of brassica—brocoli, cabbage-sprouts. All of these, in some gardens, fell at once, and finally decayed; and in most others the winter and spring supply was seriously reduced. Evergreens of all common kinds were scorched, if not killed to the ground; and again the scene of the "Murphy winter" (1837–8) was repeated with exacerbation. Nor was this to be wondered at, for the rigour of that period came on at once, commencing on January 4th, attaining its intensity on the 21st, and gradually abating till the middle of February; whereas in the late year, after a most severe December, which brought all vegetables to a state of torpor, January became mild and stimulating. Thus vegetation was somewhat re-excited, and, therefore, fell an easy sacrifice to the intense cold and occasional snow, partially thawed by a brilliant sun which at length shone throughout many hours of each day from the 1st to the 12th, with only two exceptions. The corn, however, was so protected by several inches of snow, that it suffered far less than in 1838, when, in our locality, we had not a fall of three inches throughout the winter.

We are now arrived at "the criterion month"—*March*—that month which, from its proverbial fickleness of character, was called "March many weathers;" but this was a term of the old style, and cannot equally apply to the third month of the reformed calendar. In the bygone year, little of fickleness or change could be remarked; for, in its whole course, my diary registers only eight entirely cloudy days, but eleven wherein the sun shone more or less, and twelve of complete splendour. Snow fell on the 3d, 4th, 5th, 11th, 12th, 16th, and 18th, generally in light passing clouds, with exceedingly severe frost, frequently of from 10° to 12° and 13° of intensity. The mean temperature of the first three weeks, including day and night, was below the freezing point; but, on the 20th, was one of the most perfectly clear and beautiful days of the month. The *vernal equinox* was passed by the sun entering the spring sign of Aries (or the ram) at 45 minutes past 5 o'clock of the afternoon. The barometer had then risen to nearly "set fair," (30 inches 38 cents.;) temperature, at three observations, was 26°, 37°, 28°; wind N. by W., almost calm, when, as if at the moment, while the heavens were gorgeously rich—just

before sunset—an herbaceous grassy odour, always the prognostic of a change, began to pervade the air, and, with frosty fume, the wind chopped to W.S.W. before morning.

By the ordinary rule, the state of the weather just before and at the period of the equinoxes becomes an index for that of the next summer or winter; but, in the instance alluded to, the equinox appeared to act as an instrument of change, not as a confirming power—and, in fact, whatever may be said or thought of the prognostic, certain it is that westerly winds, generally brisk or strong in their currents, got in from the early morning of the 21st, and we had rain, more or less, on six occasions between that date and the end of the month. As a general remark from repeated daily observations, I may cite what I elsewhere publicly stated at the time, that "such a period of frost, embracing 31 days prior to the 21st of March—wherein the mean temperature of the whole was below the freezing point—had not occurred since 1814; and even then there was not half the amount of easterly wind. In the above period there fell no rain, and little depth of snow." Moisture was, therefore, at a minimum; and how could it be otherwise, when the drought of 1844 was taken into the account, and February was nearly dry? These facts considered, we may safely believe that the equinox predicted the change which soon followed; and thus became a type of the seasons that, subsequently, have been attended with several phenomena strikingly anomalous, if not unprecedented.

April, "the showery," opened with perfect splendour—wind north-east—keen brisk currents and low temperature. These conditions were confirmed for a week, and on the 7th we had 3° of frost. On the 8th, and thence to the 15th, the prevailing wind was westerly. Barometer at and about "changeable," with occasional showers on seven successive days—hail on the 11th—again on the 14th and 15th with furious wind, which then went to the east, and there continued till the 26th. At the same time the barometer regained its altitude, and the weather became fine and sunny. About this period commenced that current of wind, which, blow from what quarter it might, was almost always forcible.

Without attaching faith to the theory of Mackenzie, founded upon "*the cycle of winds*," it must be confessed that the prognostic of a windy spring and summer has been verified to an extraordinary extent; and thus far the year may be compared with 1809 and 1817. After short intermission, westerly strong winds returned on the 24th, continuing, with a depressed mercurial column, till May 12th. The weather was gloomy, with showers on the 26th, 27th, and 30th of April. But the temperature, as a whole, was much improved; for, during the last week, the thermometer rose to 70° or 71°, the nights being marked 47° to 55°.

May came in fine, and continued so, with now and then a passing shower for five days. A little thunder was heard, and it soon became apparent that we should have a counterpart of that disastrous month of 1843, which so degraded the quality of the wheat-crop. After the 6th the wind became fickle and wavering, between west by south, and by north, barometer fluctuating up and down, from 29 inches 50 cents. and 29 inches 83 cents. Rain commenced in good earnest around London, ushered in on the 10th by a thunder storm; and my diary registers 14 rainy days between that date and the 29th inclusive, varied by cold scuds and hail. On the 14th the sun left us, and we had a recurrence of the nearly undeviating gloom which marked the winter; but there was this consequential difference that, in November, December, and February, solar light, however cheering, was not of vital consequence to plants, which then remained in a state of torpor; whereas in the springy month of May all nature courts the light, and organised vegetation drinks it in as the pabulum of life. It has long been remarked, and again has been proved, that, however good and salubrious, " a cool May and a windy," *a wet and sunless month*, is an *almost certain harbinger of a poor and feeble wheat-crop.* In 1843, the ears averaged scarcely an inch and half in length, but then the rich herbage had suffered under the withering influence of three nights' fierce frost and heavy snow of the second week of April. During the present spring, cold as it was, the frost, when once broken, did not return with any rigour, and there was no pre-induced debility. Still, under the paralizing influence of cold, darkness, and ever-recurring showers, the plant was weakened, the ears and blossoming stage retarded, consequently a harvest of early promise was rendered late and of doubtful quality. The average mean of all the days and nights, could not (in west Berkshire) have exceeded 53°, and only on the 1st and 27th days did my registering thermometers mark 63° as the highest temperature.

June.—When wheat does not come into bloom about, or rather before, the end of May, in the best and warmest corn districts of England, we think it highly probable that the harvest will not be early. After the desperate frost of 1838, and on two or three late springs before and after that year, I observed the first emergence of a wheat-ear, about the 16th of June, that is, soon after the close of old May. In seasons like the rich year of 1835 blossoming was perfected ere that period. In 1834 our fields abounded with sheaves and stooks by the 10th to 12th of July. It now remains to compare observations.

June 1st was fair, sunny, mild—maximum 65°: 2d was sultry, with thunder, and then showery weather followed. Brisk, not to say very strong, wind from south-west set in, with an ob-

[illegible]red atmosphere; thus a fortnight was lost. The wheat advanced little, presented not an ear, and every reasonable hope of an early harvest was weakened. Spring-corn grew well, and was thick upon the ground.

On the 9th day, however, a favourable change took place, the sun broke forth, raised the thermometer to 68°; on the 10th to 72°, 76°, 78°, and so on, till persons began to anticipate a very hot mid-summer. This sudden change from cold to great heat, and even to a warm average mean, tried vegetation severely. The apple trees had been garlands of bloom, and the fruit appeared to be setting gradually and surely. Strawberry blossom was rich, and the trusses stood high and erect. In the course of a week aridity and scorching sun had worked a sorrowful change. Entire spurs, and not the spurs only, but breast-wood, and short laterals covered with young apples, perished, as if burnt by lightning—they were killed to the main branches. The bloom of the strawberry, unless where beds had been timely deluged with water, became abortive, and so with other things. Had warm showers occurred, all would have flourished in luxuriance. As it was, torpor, and not vigour, was pre-induced; and as on the 17th the wind changed to E.N.E., and continued in that unbenign quarter for several days, the temperature fell, and nature languished under breezes, cutting as those of March, with hot sun at mid-day, paucity of dew by night, and not a single warm shower till the 27th. About the longest day the wheat came into ear pretty generally, full four weeks later than in 1835.

With south-west lively wind, fine showers, but very low temperature, June terminated, and *July* approached. It soon became evident that there would be then no summer weather, nothing that could " bring up." Easterly winds commenced on the 4th day, then four days of sun followed, and on the 6th we had 76°, or summer temperature, for a few hours. With west forcible winds, the cold returned, and our registers were gloomy from the 9th to the middle of the month. What could mature, or even tend to maturity, with an average mean temperature of 59.56°, during an entire period of 31 days, between June 20th and July 21st? And yet this period embraced the few hottest days of the summer. It is strange to read of the excessive heats of July—heats which are said to have pre-induced the noted disease of the potato crop, that subsequently spread so much alarm throughout the land. A summary of the weather, taken by me at the time, states that July came in wet; the 6th day was noted for a furious thunder storm that almost rivalled the tempests of July 6, 1836 and of 1843. With us, in Berkshire, the day was hot and beautiful, with horizontal electric corruscations at 10 and 11 [illegible] Rain fell copiously from the 9th to the 15th

—the *pseudo*-anniversary of the redoubted Swithin. On that fine day we had only one shower; the 16th was fine, and, as splendid weather frequently succeeds to a wet 15th, this degrading superstition ought to merge into the simple meteorogical fact, that July is the usual season of our periodical rain, varied, however, in accordance with the electric condition of the atmosphere. If wet weather decidedly predominate, a loss of light and heat is occasioned, which cannot be compensated generally, though corn may be successfully housed, provided August and September become very propitious. This is frequently the case in North Britain, wherein the autumns are mercifully finer than the more favoured south. Hence the abundant ingatherings which crown the labours of the skilful and assiduous farmers of Scotland.

July terminated as it commenced—average temperature barely 56°. Barometer always under 30 inches. Wind fickle, wavering from N.N.E. to W. and S.W. During the last ten days, six were decidedly cloudy; two only wherein the sun shone out at mid-day or early afternoon. On six occasions the evenings or nights were pretty clear and starry.

August commenced with wind at S. and S.E., variable in force; maximum temperature 64°, and a little sun after noon. The weather and wind very inconstant, with occasional gleams only till the 9th, when a strong westerly gale set in, though the day was one of the finest. With that brisk wind commenced a week of very gloomy weather, (wind N.W.,) the heat declining from 63° to 51° at its maximum. Then the wind changed to W. and S.W., with a little sun and milder air.

On the 20th the sun chased away the gloom, and nature assumed a new and cheerful aspect.

The average temperature, by three diurnal observations during thirty days to the above day inclusive, was—highest 61.5°, lowest 51.77°, mean 56.635°. There were eighteen days wherein rain, more or less, fell; but yet with us in west Berkshire to no great extent. It is quite astonishing how very arbitrary and local are the meteorological phenomena of districts: while the north and west were drenched, our land was dust-dry at 12 inches below the surface, and so remained for weeks. My diary contains the following summary:—" It has" (between the cited period) "been too wet; not so much as to quantity of rain, but by the ever-recurring frequency of trifling showers. Three fine days are all that our locality can register. Oats and wheat have been cut, and are cutting; but none of the latter was carried on the 20th. Oats first ricked on the 17th or 18th. No injury appears – no discoloration; but the season has been tantalizing, and far too cool to compare with the ordinary registered averages."

August terminated in splendour: scarcely a cloud was seen during the last ten days, and the two last were the warmest of the month, the average maximum being 70°, that of evening 60°. September remained dry to the 13th included, but it became cold and cheerless—wind easterly, generally by north, fresh—atmosphere gloomy on the whole, with occasional haze: hence the crops still uncut became tardily mature, and great breadths, even in the hilly districts of west Berkshire, and their watery vales, remained in the field.

On the 14th rain set in—that period of wet, bad enough here, but of a more aggravated character in less favoured localities—which proved so disastrous in Cumberland and the Border counties. It was ushered in by thunder on the 14th, and continued with little remission till the 12th of October. During the previous fine weather which was so important to the corn districts of the south, the barometer retained a degree of altitude for three weeks, which is seldom registered. With the change, the mercury fell at once, and continued to fluctuate a little above or below the "changeable" point for about 26 days.

October, at its commencement, was very unpropitious; and alarm began to spread; the agricultural reports becoming more and more lugubrious. On the 11th day, however, a change of wind brought an immediate improvement; the sun broke forth with power, and a most beautiful season followed. From the 11th to the 31st, I have registered 5 cloudy days only; all the others fine, and in many instances, beautiful in the extreme. The nights, too, vied with the days; and, among other beauties, the extraordinary positions of the four planets, which the unassisted eye can observe, were all visible at the same time—Venus low in the west, Saturn in the south-west, Mars in a right line to the east of Saturn, and Jupiter to the east of Mars.

October, when serene and mild, is a delicious month, and to the agriculturist it is peculiarly important. In the south it has furnished one of the most propitious wheat seasons imaginable, and never has seed been committed to a finer bed. In the north all reports agree that the fine weather has cleared the fields of those crops which were jeopardized by the untimely rains of the four weeks before alluded to.

The average temperature by night was about 43°. There were three frosts on the 23d, 24th, and 26th; a little ice was found, but the days became warm and sunny. As October closed, so commenced

November—the day was warm, the night gentle. Thus passed three entire days; the sun bright as in April, if we except a few clouds in the afternoon of the 2d. The wind was steady E,

The third night, however, became keen, and the morning of the 4th dawned with a strong frosty rime, and at least 4° below 32°, and were marked by the self-registering thermometer. Then the barometer, which had ranged exceedingly high, began to recede from 30 inches 30 cents.; and ere long it was at 30.

The 5th day was partially overcast after rime, with occasional gleams; the upper current became south-westerly, and the temperature rose to 50°. Under these circumstances we anticipate a change, and rain, which, in fact, will be desirable, as the earth becomes very dry.

Having thus brought up my observation to the latest period, I conclude with the hope of a mild open winter, favourable to the poor and to all the timely operations of the field.

Cause of the Disease in the Potato. By Graeme Paterson, Gardener, Dunning.*—As every practical hint for raising and keeping potatoes that will make *good seed* is of importance, we readily give Mr Paterson's ideas on those subjects, though they are by no means discoveries as he imagines.

His plan for *raising* seed potatoes is—To plant them on land that had never grown potatoes before, plenty of which sort of land may be found on the faces of our hills, and the soil should be of a different nature from that on which the potatoes to be used for seed there had been raised. He planted *diseased* potatoes on such soil in April 1843, with very little manure, and the crop proved good, though there were some diseased potatoes amongst them. A part of this new crop he planted in April 1844, in the same sort of natural ground, but not in the same place, and he lifted a beautiful crop, wholly free from disease. And his mode of *keeping* seed potatoes is—To make a trench ten or twelve inches deep, if the soil is dry, and less if not, in ground situate on the north side of a hedge, or house, or wall, and four feet in width, throwing out the earth on both sides for covering. The potatoes, when brought from the field, are spread thinly on the bottom of the pit, and then covered with a layer of earth. Another layer of potatoes is placed on this earth, and then another layer of earth above them, and so on alternately until the pit is high enough. Put no straw, but plenty of earth, and the looser the better; for frost will not penetrate loose earth, and all the rain it will absorb will do no harm but good, by keeping back vegetation. The advantages of this mode of pitting potatoes are, that they will not spring so soon, and will, therefore, require little or no picking; they will retain their natural juices, and, therefore, will be heavy and measure well; and they will be of better quality.

AGRICULTURAL REPORT.

December 1845.

This has been an eventful quarter for the agriculturist. It has been to him a period of hopes and fears, of apprehension and gratulation. In the earlier part, the frequent showers created fears of the maturing of the crop, while the continued coldness

* A Discovery of the Cause of that Disease in Potatoes commonly called Dry-rot. By Graeme Paterson, Gardener, Dunning. Perth. 1845.

of the air gave assurance that none of the grain had yet sprouted. As the season advanced, apprehensions were entertained whether the crop would be secured in a safe state; while the cool air—the breeze from the north between the intervals of rain—quickly drying the standing corn, and soon making it fit for the stack-yard, did service beyond expectation. Considering the contingencies it had to encounter, and the great bulk it had attained, few crops have been secured in a *sounder* state than the present.

October is usually dry and clear in this climate. This year it was more like November, and November assumed somewhat the character of October, inasmuch as it was comparatively dry and cold, though not clear, and it has produced very heavy gales. Indicative of wind, the barometer became unusually unsteady, rising and falling alternately nearly an inch in the course of a single night, and it continues to oscillate. The wind, strong, has been from the west to south-west; the air has felt very fresh, much less frosty, indeed, than in summer. The weather is quite open, and is favourable to all field operations going on uninterruptedly.

Owing to the great solicitude felt for the state of the crop, its produce has been most accurately ascertained. It is bulky as regards straw: indeed, in the higher districts, the most uniformly bulky one we ever saw. There is great diversity of quality in the wheat, some weighing as low as 50 lb. per bushel, whilst others are fine, and as heavy as 66 lb. Barley is of fair quality, though it malts unequally. Oats are uniformly good, and produce good and abundant meal. In quantity, wheat yields in an ordinary degree, while barley and oats are both abundant; indeed, the oats in Ireland have yielded the largest crop for many years. There is a large proportion of light corn. Beans are bulky in straw, and, in many instances, prolific. Pastures have never failed all the season, the aftermath being unusually abundant, and even yet the open weather causes the grass fields to appear green and inviting. The young clovers look healthy and promising. Although the turnips came quickly away, and were soon ready for thinning, they have continued to grow till now, and are a good crop, except on thin, wet, clay soils, especially where late sown, where they *set up*, and are an indifferent crop. The turnips are well spoken of in England and Ireland. The potatoes grew luxuriantly during the moist weather; and but for the malady which overtook them, and could not be averted, they would have yielded both a great and good crop. We mentioned in our last report that this malady had attacked the potato in the south of England. Although apprehensions existed in this country in regard to the potato crop, no disease, to any extent, [illegible] was taken up, when

many exhibited liver-coloured spots upon them; and the removal of the skin from which parts shewed that the flesh was discoloured with streaks of brown and black, and in some cases was in a state of rottenness. The nature of the malady has been so much discussed in the newspapers, that it is unnecessary to dilate upon it here. The loss sustained by it may be about one-fourth of the crop. The affection, however, has been arrested in its progress. The autumn wheat was sown under pretty favourable circumstances of weather and soil—the seed being chiefly supplied by the last year's crop.

The Falkirk Trysts, which are much the largest markets of supply of stock in this country, were well attended by cattle and sheep in the finest condition, and the prices exceeded those in the similar trysts of last year—an expected result, from both turnips and fodder being great in England. All-Hallow Fair, which winds up the large stock markets for the season, also realized good prices for good stock; but the demand at that market is merely local, chiefly for winterings and fattening cattle by those who wish to lay in late.

The corn markets have exhibited an unusual activity. The inferior quality of part of our wheat crop has induced foreigners to send every parcel of good wheat they have, and the holders in bond retain theirs in the hope of coming into the home-market at a low duty. This expectation is likely to be disappointed; for, though fine wheat is still 63s. per quarter in Mark Lane, though on the decline, the low price of the inferior wheat keeps the aggregate average so low as to maintain the import duty still at 14s. per quarter. The prices of grain are in a very anomalous state. Mark Lane is regarded as the barometer of the prices of corn, but the Edinburgh market has topped the Mark Lane a long way. In the first week of September, Mark Lane exceeded Edinburgh by 3s. 2d. per quarter for wheat, but on the 29th November, Edinburgh was no less than 21s. 1d. per quarter in advance of Mark Lane, and so in proportion with other grains. Are the Scotch grains of finer quality than the English? The unsettled state of the political horizon has had a most depressing effect on the grain market. Wheat fell in Edinburgh on the 10th December from 7s. to 10s. per quarter.

A cry of famine has been raised in the land by the partisans of the Anti-corn-law League. Were a famine really sent as an infliction upon our country by an All-wise Providence we should cleave to the dust in utter humility; but a League-famine we would despise with a merry heart, had it not been proclaimed with fearful impiety, and exulted in with heartless ingratitude. Fortunately we can reiterate our former statement that there is plenty in the land for man and beast.

CORRIGENDA.

A foot-note, which we put at p. 168 of Mr Carmichael's Essay on the Keeping of Farm-Horses, in the last Number of the Society's Transactions, to the effect that "no kind of grain, or straw, or chaff, *can* be cooked by steaming," has, it seems, led to misapprehension. Grain, straw, or chaff, when *in water*, or *after having been steeped in water*, can be cooked by the application of the heating power of steam. What we should have therefore, said, is this—"That no *dry* grain, straw, or chaff, when acted upon *solely* by *high*-pressure steam, can be cooked, but will be charred;" and this was our meaning.

There are two sentences in the leading article of this Number on Rent which require improvement in their construction—viz., At p. 139, line 20 from the top, the sentence should read thus—"for landlords do not raise the rents of respectable tenants, because that would be generally felt as a harsh measure, however justly they are entitled to do it;" and at p. 144, line 23 from the top, the line should read thus—"is the only one which cannot be afforded to be grown."

THE REVENUE.

ABSTRACT of the Nett Produce of the Revenue of Great Britain, in the Quarters and Years ended on the 10th of Oct. 1844 and 10th of Oct. 1845—shewing the Increase and Decrease on each head thereof.

	Quarters ending Oct. 10.		Increase.	Decrease.	Years ending Oct. 10.		Increase.	Decrease.
	1844.	1845.			1844.	1845.		
	L.	L.	L.	L.	L.	L.	L.	L.
Customs, ...	6,002,855	4,848,363	. .	1,154,492	20,243,505	18,652,558	. .	1,590,963
Excise, ...	3,960,890	2,955,106	. .	5,784	11,959,942	12,069,215	109,274	. .
Stamps, ...	1,665,688	1,780,175	114,487	. .	6,533,385	6,961,370	427,985	. .
Taxes, ...	201,439	201,279	. .	160	4,204,855	4,228,281	23,426	. .
Post-Office, . .	200,000	209,000	9,000	. .	672,000	688,000	16,000	. .
Miscellaneous, .	230,961	495,102	264,141	. .	831,357	1,046,960	216,603	. .
Property Tax, .	1,958,711	1,823,883	. .	134,828	5,158,470	5,127,126	. .	31,344
	14,220,544	12,312,908	387,628	1,295,264	49,603,514	48,773,504	793,288	1,622,297
		Deduct Increase,		387,628	Deduct Increase,			793,288
		Decrease on the Qr.		907,636	Decrease on the Year,			829,009

FOREIGN MARKETS, per Imperial Quarter, free on Board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1845.							
Sept.	Dantzig.	38/ to 45/0	22/6 to 25/6	12/6 to 15/	29/6 to 32/	34/6 to 40/	32/6 to 40/
Oct.	..	42/ 54/	24/ 27/6	14/4 18/6	30/ 35/	38/ 43/	44/ 42/6
Nov.	..	52/ 59/	22/ 27/	15/6 21/	32/6 37/6	36/6 45/	36/ 44/
Sept.	Hamburg.	32/ 40/9	19/ 23/	14/6 18/	28/ 30/6	34/6 40/6	30/ 36/
Oct.	..	36/ 46/	26/4 28/8	16/6 20/6	30/ 32/6	40/ 44/6	32/6 39/
Nov.	..	50/ 58/6	22/6 30/6	17/6 24/6	30/6 33/	38/6 48/	34/ 46/
Sept.	Bremen.	39/6 47/6	21/6 28/6	14/6 18/6	30/ 34/	30/6 37/6	32/ 38/
Oct.	..	46/ 52/	22/ 29/6	16/6 22/	32/6 36/	33/ 42/6	33/6 41/6
Nov.	..	45/6 53/	20/6 28/6	16/ 19/6	33/6 39/	36/6 45/	36/ 42/6
Sept.	Konigsburg.	40/6 48/	20/ 28/	15/6 19/	24/ 30/6	30/ 38/	30/6 36/6
Oct.	..	50/ 57/	26/6 34/	16/ 21/	27/6 36/6	32/6 42/	33/6 40/6
Nov.	..	52/6 58/6	25/ 30/6	18/6 24/	34/6 40/	38/6 43/6	37/6 42/6

[illegible]e Freight from the Baltic and the north of Europe was in September from 3/ to 5/ per Quarter free on board, and increased to from 5/ to 8/ in November—from the Mediterranean and Black Sea, it was from [illegible]6 to 10/6, but inc[illegible] [illegible]/ to 17/ thus raising the [illegible] to nearly 60/ per Quarter from Odessa [illegible] Black Sea.

TABLE OF PRICES, &c.

erage Prices of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets :—

LONDON.

Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Rye. s.	d.	Pease. s.	d.	Beans. s.	d.
60	0	30	5	22	6	34	6	36	6	41	10
56	5	27	10	21	10	33	8	37	1	43	1
56	6	31	2	22	3	33	2	37	9	43	6
57	6	32	2	24	6	32	6	38	2	39	5
60	1	29	11	24	10	33	8	40	10	42	8
61	10	35	4	24	9	34	2	42	8	42	6
63	4	34	4	25	0	34	6	44	2	40	8
64	0	36	7	26	7	35	8	43	10	41	9
65	4	36	8	26	5	36	4	45	6	42	6
65	10	38	4	27	10	37	6	46	6	43	2
64	4	38	5	29	7	38	0	45	8	44	11
63	3	36	1	29	6	37	2	46	2	43	2
62	11	36	9	27	2	36	4	45	10	41	8

EDINBURGH.

Date.		Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Pease. s.	d.	Beans. s.	d.
1845.											
Sept.	3.	56	10	28	10	27	6	46	0	46	10
	10.	68	0	31	6	30	0	47	6	48	0
	17.	67	0	32	0	29	4	46	8	47	2
	24.	67	6	33	0	30	0	46	4	47	0
Oct.	1.	72	0	34	0	30	8	48	0	49	0
	8.	74	0	35	0	31	4	50	0	52	0
	15.	76	0	37	0	32	8	50	8	52	0
	22.	64	0	40	0	36	0	50	6	52	6
	29.	66	0	42	0	35	8	52	0	53	0
Nov.	5.	66	0	42	6	38	4	50	0	51	0
	12.	64	0	40	0	36	8	50	0	52	6
	19.	63	6	41	0	34	0	51	0	52	0
	26.	64	0	40	6	35	4	50	0	51	2

LIVERPOOL.

	Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Rye. s.	d.	Pease. s.	d.	Beans. s.	d.
6.	54	7	30	6	22	4	34	2	39	2	40	0
3.	52	11	31	8	21	4	34	6	38	6	44	6
0.	51	1	33	6	20	7	33	10	37	10	43	6
7.	53	8	31	8	22	9	33	6	38	6	45	0
4.	56	0	28	9	22	8	33	2	39	6	45	0
1.	55	5	30	2	22	6	33	8	40	8	38	4
8.	57	4	30	7	22	11	34	4	42	6	44	0
5.	57	6	33	1	23	11	34	10	44	9	47	9
1.	58	8	32	4	24	1	35	0	45	6	50	10
8.	57	3	33	6	25	4	34	8	45	10	43	0
5.	57	4	34	2	26	8	35	4	44	9	45	8
2.	60	4	35	7	27	2	35	6	44	6	42	11
9.	59	5	33	10	26	10	35	8	45	9	48	7

DUBLIN.

Date.		Wheat per Barrel 20 St. s.	d.	Barley per Barrel 16 St. s.	d.	Bear per Barrel 17 St. s.	d.	Oats per Barrel 14 St. s.	d.	Flour per Barrel 9 St. s.	d.
1845.											
Sept.	5.	28	10	13	10	11	5	13	1	17	4
	12.	26	2	14	4	11	3	12	7	17	2
	19.	27	6	14	0	11	7	12	9	16	10
	26.	28	9	14	4	11	11	13	0	17	3
Oct.	2.	29	1	14	2	12	0	13	4	17	4
	9.	28	10	14	6	11	9	13	2	17	6
	16.	29	6	15	0	12	3	13	6	17	8
	23.	30	4	15	2	12	4	13	4	18	9
	30.	32	3	15	10	13	2	14	0	19	2
Nov.	6.	32	10	15	9	13	4	14	2	20	0
	13.	32	4	17	10	14	11	15	2	20	10
	20.	34	8	17	8	14	10	15	4	20	9
	27.	34	3	16	6	14	2	15	0	20	10

E shewing the Weekly Average Prices of GRAIN, made up in terms of 7th and 8th Geo. IV., 58, and 5th Vict., c. 14, and the Aggregate Averages which regulate the Duties payable on OREIGN CORN: the Duties payable thereon, from September to December **1845.**

Wheat. Weekly Average. s.	d.	Aggregate Average. s.	d.	Duty. s.	d.	Barley. Weekly Average. s.	d.	Aggregate Average. s.	d.	Duty. s.	d.	Oats. Weekly Average. s.	d.	Aggregate Average. s.	d.	Duty. s.	d.
55	10	55	10	17	0	31	8	30	0	8	0	22	0	22	6	6	0
54	1	55	11	17	0	31	0	30	2	8	0	22	3	22	6	6	0
52	6	55	6	17	0	30	9	30	5	8	0	21	7	22	4	6	0
53	2	54	10	18	0	30	2	30	7	8	0	22	2	22	5	6	0
56	0	54	8	18	0	31	1	30	9	8	0	23	4	22	6	6	0
57	9	54	11	18	0	31	3	31	0	7	0	23	6	22	7	6	0
58	2	55	3	17	0	32	2	31	2	7	0	23	5	22	8	6	0
59	5	56	2	16	0	33	0	31	4	7	0	24	11	23	1	5	0
60	1	57	5	15	0	34	3	31	11	7	0	26	2	23	11	5	0
59	7	58	6	14	0	35	1	32	9	6	0	25	2	24	5	4	0
58	6	58	11	14	0	35	0	33	5	5	0	26	3	24	10	4	0
57	11	58	10	14	0	34	1	33	11	5	0	25	5	25	3	3	0
58	2	58	11	14	0	33	2	34	1	4	0	25	0	25	6	3	0

Rye. Weekly Average. s.	d.	Aggregate Average. s.	d.	Duty. s.	d.	Pease. Weekly Average. s.	d.	Aggregate Average. s.	d.	Duty. s.	d.	Beans. Weekly Average. s.	d.	Aggregate Average. s.	d.	Duty. s.	d.
33	5	34	2	8	6	36	9	38	11	4	6	42	2	41	5	1	6
33	2	33	11	9	6	36	5	38	2	4	6	42	10	41	10	1	6
32	8	33	9	9	6	37	0	37	10	5	6	42	5	42	1	1	0
33	1	33	7	9	6	38	9	37	8	5	6	42	5	42	3	1	0
33	8	33	6	9	6	42	6	38	6	4	6	43	1	42	6	1	0
34	2	33	4	9	6	41	4	39	3	3	6	43	2	42	8	1	0
34	5	33	6	9	6	43	0	40	4	2	6	44	5	43	1	1	0
34	6	33	9	9	6	44	5	41	7	1	0	45	5	43	6	1	0
33	2	33	10	9	6	43	10	42	9	1	0	45	3	43	11	1	0
35	7	34	3	8	6	44	9	43	9	1	0	45	1	44	3	1	0
38	9	35	0	7	6	45	7	44	3	1	0	44	6	44	8	1	0
37	1	35	6	7	6	45	4	44	5	1	0	43	4	44	6	1	0
35	4	35	8	7	6	45	10	44	11	1	0	41	9	44	2	1	0

The MONTHLY RETURNS, published in terms of 9th Geo. IV., c. 60, shewing the Quantiti[es of] Corn, Grain, Meal, and Flour imported into the United Kingdom in each Month; the Quan[tities] upon which duties have been paid for home-consumption, during the same Month; and the Q[uan]tities remaining in Warehouse at the close thereof, from 5th September to 5th November 1845.

Month ending	IMPORTED. From Foreign Countries.	IMPORTED. From British Possessions.	IMPORTED. Total.	CHARGED WITH DUTY. From Foreign Countries.	CHARGED WITH DUTY. From British Possessions.	CHARGED WITH DUTY. Total.	REMAINING IN WAREHOUSE. From Foreign Countries.	REMAINING IN WAREHOUSE. From British Possessions.	REMAINING IN WAREHOUSE. Tot[al].
Sep. 5, 1845.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs.
Wheat, .	44,828 4	3,665 2	48,493 6	1,655 3	3,700 4	5,355 7	444,324 6	84 2	444,4
Barley, .	15,587 6	2,823 5	18,411 3	8,231 4	2,029 7	10,261 3	58,933 2	794 3	59,7
Oats, . .	81,959 3	3,366 2	85,325 5	90,349 6	3,047 2	93,397 0	88,628 5	485 7	89,11
Rye, . . .	. .	. .	. .	. .	. .	. .	. .	. .	.
Pease, .	3,649 4	3,691 6	7,340 2	5,137 4	3,691 6	8,829 2	11,420 6	. .	11,4
Beans, .	15,411 1	. .	15,411 1	23,142 7	. .	23,142 7	48,073 4	. .	48,0
Totals,	161,435 2	13,546 7	174,982 1	128,517 0	12,469 3	140,986 3	651,380 7	1,364 4	652,2
Oct. 5, 1845.									
Wheat, .	111,164 3	6,198 5	117,363 0	14,691 6	6,216 3	20,908 1	543,666 6	. .	543,66
Barley, .	18,387 4	783 2	19,170 6	5,134 7	763 2	5,895 1	57,664 2	814 6	58,47
Oats, . .	88,108 6	2,310 7	90,419 5	73,613 2	1,699 7	75,313 1	102,033 6	1,096 4	103,13
Rye, . .	. .	. .	. .	. .	. .	. .	. .	. .	.
Pease, . .	1,558 4	2,223 6	3,782 2	8,856 6	1,685 3	10,542 1	1,115 4	540 2	1,65
Beans, . .	11,591 6	51 4	11,643 2	53,390 2	51 4	53,141 6	6,805 5	. .	6,80
Totals,	230,810 7	11,568 0	242,378 7	155,686 7	10,416 3	166,063 2	711,285 7	2,451 4	713,73
Nov. 5, 1845.									
Wheat, .	149,484 2	898 4	150,382 6	809 6	821 4	1,631 2	667,698 3	75 2	667,77
Barley, .	7,828 6	. .	7,828 6	4,523 4	685 6	5,209 2	59,432 2	45 6	59,47
Oats, . .	28,958 4	415 6	29,374 2	14,517 6	1,458 4	15,976 2	107,219 6	. .	107,1
Rye, . .	. .	. .	. .	. .	. .	. .	. .	. .	.
Pease, .	1,944 6	43 2	1,988 0	566 7	584 1	1,151 0	2,063 6	. .	2,06
Beans, .	11,325 2	. .	11,325 2	14,860 5	. .	14,960 5	1,678 7	. .	1,67
Totals,	199,541 4	1,357 4	200,899 0	35,279 4	3,549 7	38,828 3	838,093 0	121 0	835,21
Sep. 5, 1845	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. q
Flour, .	918 2 16	69,674 1 12	70,593 0 0	270 2 16	72,623 1 16	72,894 0 4	219,713 2 8	2,576 1 18	222,29
Oatmeal,	. .	656 2 24	656 2 24	. .	453 2 12	453 2 12	160 3 12	162 3 11	323
Totals,	918 2 16	70,331 0 8	71,249 2 24	270 2 16	73,077 0 0	73,347 2 16	219,873 1 20	2,739 1 1	222,613
Oct. 5, 1845.									
Flour, . .	8,108 1 6	124,122 2 14	132,230 3 20	1,176 2 12	110,857 3 8	112,034 1 20	225,306 1 18	15,788 1 8	241,094
Oatmeal,	42 2 18	391 2 10	434 1 0	. .	430 1 4	430 1 4	160 3 12	52 2 18	213
Totals,	8,150 3 24	124,514 0 24	132,665 0 20	1,176 2 12	111,288 0 12	112,464 2 24	225,468 1 2	15,840 3 26	241,308
Nov. 5, 1845.									
Flour, . .	39,060 1 6	87,545 2 19	126,605 3 25	85 2 14	84,982 2 16	85,068 1 2	261,720 3 8	169,63 1 2	278,684
Oatmeal,	4 2 20	41 3 25	46 2 17	. .	51 2 6	51 2 6	160 3 12	2 2 18	163
Totals,	39,064 3 26	87,587 2 16	126,652 2 14	85 2 14	85,034 0 22	85,119 3 8	261,881 2 20	16,966 0 10	278,847

PRICES of BUTCHER-MEAT.

Date.	LONDON, *Per Stone of* 14 lb. Beef.	LONDON, Mutton.	LIVERPOOL, *Per Stone of* 14 lb. Beef.	LIVERPOOL, Mutton.	MORPETH, *Per Stone of* 14 lb. Beef.	MORPETH, Mutton.	EDINBURGH, *Per Stone of* 14 lb. Beef.	EDINBURGH, Mutton.	GLASGOW, *Per Stone of* 14 lb. Beef.	GLASGOW, Mutt[on].
1845.										
Sep.	6/6 to 8/	6/9 to 9/	5/9 to 7/9	6/ to 8/	6/ to 8/	6/3 to 8/	6/ to 7/6	5/3 to 7/3	5/9 to 8/	5/6 to 7
Oct.	6/9 8/3	6/9 8/9	6/3 8/3	6/3 8/3	6/3 8/	6/ 8/	6/3 7/9	5/6 7/3	5/6 7/9	5/9 7
Nov.	6/9 8/	6/6 8/6	6/3 8/3	6/6 8/3	6/3 8/	6/6 8/3	6/3 7/9	5/6 7/6	5/9 7/9	6/

PRICES of English and Scotch WOOL.

English, per 14 lb.		
Merino, ...	15/	to 21/6
in grease, . . .	13/	17/
South Down, . .	17/6	22/
Half Bred, . . .	14/	17/6
Leicester Hogg,	16/	21/
E[illegible] Hogg,	13	6/6
Lock.	[illegible]	1/
Moor	[illegible]	3/9

Scotch, per 14 lb.		
Leicester Hogg, . . .	15/	to 21/6
Ewe and Hogg, . . .	12/	15/
Cheviot, white, . . .	11/	14/6
Laid, washed, . . .	8/	11/6
unwashed, . . .	7/	9/6
Moor, white, . . .	6/6	8/
Laid, washed, . . .	4/3	6/9
unwashed, . . .	3/3	5/9

REPORT OF THE COMMITTEE OF MANAGEMENT OF THE AGRICULTURAL CHEMISTRY ASSOCIATION OF SCOTLAND.

THE Committee will divide their Report into three parts, referring—

1*st*, To what has been done during the last six months under the direction, or with the sanction, of the Committee.

2*d*, To the present state of the Association.

3*d*, To the utility of the Association, and its prospects.

I. In narrating what has been done since the last General Meeting in July, the Committee will draw attention to the following particulars, making a few observations on each:—

(1.) Work done in the Laboratory.
(2.) Monthly Reports by the Chemist of the Association.
(3.) Lectures in different parts of Scotland.
(4.) Visits to Districts with the view of suggesting Improvements.
(5.) Public Breakfasts at Dumfries for discussing questions of interest.
(6.) Experiments by practical Agriculturists, suggested by the Chemist.
(7.) Quarterly Publication of proceedings of the Association.

(1.) *The work performed in the Laboratory* is of two kinds. *First*, Purely analytical; and, *Second*, Reports upon the analyses made, with a voluminous correspondence regarding articles transmitted to and from the Laboratory, arrangements for lectures and excursions, and answers to queries of members, all of which has been conducted by Professor Johnston.

The number of analyses made in the Laboratory during the last six months has amounted to 210, of which 140, or two-thirds, have been of substances sent for analysis chiefly by members of the Association—the remaining 70 analyses, or one-third of the whole, being at the expense of Professor Johnston himself, in prosecution of trains of analytical research, with the view of enlarging our knowledge of the application of chemical science to agriculture.

The general nature of the analyses made in the Laboratory during the last six months is exhibited in the following Table, which shews also the relative numbers, compared with the previous six months of the present year:—

Analyses made in 1845.

	From January to July.	From July to December.	Whole Year.
Guanos and other Manures, . . .	173	75	248
Soils, Tile and Fire Clays, ...	86	25	111
Limestones and Marls, ...	16	10	26
Iron and Manganese Ores, ...	11	4	15
Waters, ...	5	7	12
Turnips, ...	9	4	13
Oil-cakes, ...	—	3	3
Refuse of Manufactories, ...	5	5	10
Miscellaneous, ...	10	7	17
	315	140	455
ANALYTICAL RESEARCHES.			
Organic—			
Analyses of Potatoes, ...	—	7	7
Determination of Nitrogen in Oats, Barley, and Oil-cakes, . . .	—	23	23
Inorganic—			
Slates, and other Rocks, ...	7	—	7
Ashes of Oats, Potatoes, (tubers and tops,) Wheat, Barley, and Oil-cakes,	40	40	80
	362	210	572

This Table shews that the number of analyses made during the latter six months has been considerably less than during the former six months of the present year. This arose partly from the circumstance that there always is a greater demand for analyses in the spring months, and partly from the circumstance that the ships loaded with guanos arrive also during these months.

Among the substances mentioned in the foregoing list as having been analysed, are different oil-cakes. It is a remarkable fact, considering the great extent to which this article is used, and the length of time it has been employed, that its accurate chemical composition should have been so long unknown. The analysis of three kinds of oil-cake, which has recently been made in the Laboratory of the Association, is, therefore, an important benefit conferred both on the science and on the practice of agriculture. And it may serve to impress upon the minds of some members the degree of care and the length of time which such analyses demand, that it required the repeated investigations of two of his assistants during a period of three months, to satisfy your Chemist that a fair degree of reliance was to be placed upon these results. The results themselves have just been made public in the Report given to the Highland Society of the Proceedings of the Association, and which is published in the January number of their Transactions

Some of the practical benefits to the farmer arising from this analysis are indicated by the following propositions:—

1. That the per-centage of the protein compounds, in the analysis called gluten and albumen, is nearly equal to what is contained in pease and beans, and that, therefore, for the production of milk for the cheese-dairy, and also for laying on muscle, oil-cakes are as valuable as beans, pease, or clovers. This is a result somewhat unexpected, inasmuch as the value of oil-cakes in the feeding of stock has hitherto been supposed to depend very much upon their power of laying on fat: in other words, upon the per-centage of oil they contain.

2. The proportion of oil in these cakes is greater than is naturally present in any species of grain or pulse usually cultivated. Oats contain as a maximum about 7, and Indian corn about 9 per cent. of oil, but these cakes contain 12 per cent., and are, therefore, in their ability to supply fat to an animal, superior to any of our cultivated grains.

3. These oil-cakes leave six per cent. of ash, of which one-third consists of phosphoric acid: 100 lbs. of oil-cake, therefore, contain 2 lbs. of phosphoric acid. On the other hand, our common kinds of corn—wheat, for example—leave only two per cent. of ash, of which one-half consists of phosphoric acid, or 100 lbs. of wheat contain 1 lb. of phosphoric acid. *Therefore*, for laying on *bone*, or for supplying the materials of bone to growing stock, *oil-cake is twice as valuable as wheat*, weight for weight, and *more than twice as valuable as oats or barley* which are covered with a husk.

4. Again, the same reasoning shews that, as grains of all kinds draw their phosphoric acid from the soil, these oily seeds will exhaust the soil of its phosphates to a much greater degree than our corn-crops: 100 lbs. of linseed will carry off twice as much of them from the soil as 100 lbs. of wheat.

5. But the same circumstance supplies an additional reason why the manure of *full-grown* store stock fed upon oil-cake is so much richer than that obtained by the use of any other kind of food. It is richer—

a. Because the proportion of the protein compounds (albumen, &c.) in the oil-cake is greater than the fattening animal can appropriate, and thus much of them passes off in a more or less changed state, and is mixed with the dung.

b. The oil also is in larger proportion than can at times be laid on their bodies even by fattening stock, and this unquestionably contributes to the fertilizing quality of the manure.

c. But the full-grown animal appropriates scarcely any of the *phosphates*—the whole of these, therefore, which the animal consumes in its food, appears again in its dung. And the oil-

cakes being richer in these phosphates, weight for weight, than any kind of corn used for food, the dung thus made is also richer in these phosphates than that which is obtained from animals fed upon almost any other kind of food.

These analyses of oil-cakes have enabled your Chemist to take up the consideration of a question submitted to him at the last January meeting of the Association, viz.—"*Whether any substitute can be recommended for oil-cake in the feeding of cattle?*"—a question which, of course, could not be answered until a complete analytical investigation of the different known oil-cakes had been accomplished. This question members will find answered in the part of the Association's Proceedings just referred to, and in which are given three prescriptions for compounding substitutes for oil-cake. Whether these compounds can be made at a cheaper rate than the price of oil-cake is a separate point which remains to be investigated, and which the Committee hope will engage the practical men.

Among the other articles analysed in the Laboratory during the last six months, were marls, limestones, soils, the refuse of several manufactories, and certain liquid manures sent from Lanarkshire by Mr Houldsworth. Several of the more interesting of these analyses, and the deductions to be drawn from them, will be found in the part of our Proceedings just published, to which we again refer members of the Association.

In regard to the other branch of the business performed in the Laboratory—the reports and correspondence connected with the business of the Association—this is much more onerous than many persons who are unacquainted with the working of the Association would at first suppose. Of reports and other letters, no less than 350 have been written and dispatched to various members of the Association during the last six months. When it is considered that many, of the reports especially, demand much care and thought, it will appear that this part of the Chemist's duties is both laborious and highly responsible. At the same time the Committee would express their satisfaction that so many of the members should be desirous of availing themselves of the advantages which, by means of such correspondence, this Association places within their reach.

To the Laboratory itself the Committee would draw the attention of the Association as highly deserving of a visit from members, both for the purpose of satisfying their curiosity in regard to the extent, kind of work carried on, and of giving them an idea of the amount of time, labour, and skill, which are necessary to the attainment of that degree of accuracy for even simple analyses, which it is one main object of the Association to secure. The Laboratory is situated in Bank Street, and contains

seven apartments, in which analytical operations of various kinds are continually carried on.

(2.) *Monthly Reports by the Chemist.*

The Monthly Meetings at which these reports are made originated in a desire on the part of many members of the Association to have an opportunity of learning what was going on in the Laboratory, and of having discussions or conversations on such matters of practical interest as might then be reported on.

It was certainly an error, in establishing this Association, not to have devised some mothod by which the nature of the operations in the Laboratory could be made known to subscribers; for, except through the half-yearly reports of the Committee to the General Meetings, there was no way in which they could learn that such an establishment was in active operation, unless, indeed, they happened to apply for analysis or advice.

This want of information in regard to the proceedings of the Association suggested the propriety of adopting some means by which the Members might be enabled to judge for themselves of the efforts made to promote the objects of the Association by all its officers, both paid and honorary.

With this view, Monthly Meetings were appointed to be held in the Laboratory, at which your Chemist should report what was going on there in the way of analyses, and should, at the same time, state anything of interest observed by him when lecturing, in the interval, in different districts. At these meetings an account is given, not merely of the nature of the analytical investigations going on, but also of their bearing on the theory of agriculture, and of their practical value to the working farmer.

During the last six months, several of these Monthly Meetings were held, at which, after reports had been made on particular subjects of interest then under investigation in the Laboratory, discussions of a practical nature arose among those present. On one of these occasions allusion was made to the waste in the town of Edinburgh, not only of night-soil, but also of street rakings, which, being composed of crushed traprocks, contain a large per-centage of lime and alkaline substances very useful to the farmer. These rakings, it appears, are carted to the sea-shore, near Leith, at a great expense, and all persons are, under a penalty, prohibited from removing them; some parties present undertook to bring this subject under the consideration of the Police Commissioners and Road Trustees.

These meetings it is proposed to resume in February, and to continue during the spring and summer, except during the months of May and June, when Professor Johnston must, as usual, be in Durham.

(3.) *Lectures Delivered in Different Parts of Scotland.*

The following are the places at which Lectures have been delivered during the last half-year, with the dates:—

At Wick,	on July	16.	At Dunse,	on Aug.	26.
— Thurso,	—	18.	— Islay,	—	29.
— Golspie,	—	22.	— Do.	Sept.	3.
— Dingwall,	—	23.	— Lauder,	—	29.
— Inverness,	—	29, 30.	— Dumfries,	October	7, 9,
— Elgin,	Aug.	1.	— Do.	—	13, 14, 15.
			— Lanark,	—	16, 18.

The subjects of these 18 lectures were chosen in most cases by the parties who applied for them, and were on the general principles of manuring and cultivating the soil, on irrigation, on the deepening of the soil, and on other topics having more or less especial reference to the districts in which the lectures were delivered. At Inverness, one of the lectures was upon the interesting question—"Whether it is possible, and is likely to be economical, to grow the same kind of crop on the same soil for many years in succession?" a fact which shews how much attention the practical men in that district have begun to pay to the more intricate relations of Chemistry to Agriculture, now under discussion among scientific men. At Dumfries, the Dumfries and Stewartry of Kirkcudbright Agricultural Society selected as the subject of three lectures, the mode of teaching Agricultural Chemistry in common schools; and, besides agriculturists, there was at that place, on the express invitation of the Society, a large attendance of the schoolmasters of the district. At Lanark it was arranged that, instead of a lecture on one of the days, an excursion through a part of the neighbourhood should be taken, which, however, the wetness of the day rendered much less satisfactory than it would otherwise have been.

The Lectures were in all cases well attended, and were generally either preceded by a public breakfast or followed by a dinner, at both of which your Chemist had additional opportunities afforded him of communicating information, and of offering suggestions to the agriculturists of the district.

It may be proper also to mention that an application having been made on the part of the parochial schoolmasters of Scotland, through their Preses, for three lectures on the best mode of teaching the elements of Agricultural Chemistry to older boys in their schools, Professor Johnston complied with the request, and gave gratuitously the lectures solicited. They were attended by upwards of 400 schoolmasters, and excited among them the deepest interest. Whilst noticing the lectures to the schoolmasters, the Committee may also advert to an examination which

took place, on the occasion of the Highland Society's Show at Dumfries, of boys and young men instructed in Scotch schools in the elements of Agricultural Chemistry. They understand that the result was most satisfactory.

(4.) *Visits to Districts with the view of Suggesting Improvements, &c.*

Among his numerous excursions during the last summer, your Chemical officer spent five days in Islay, with the view both of lecturing to the population, which is all more or less agricultural, and of offering any suggestions that might occur to him as likely to improve the husbandry of the island.

A number of suggestions did occur to him, which he communicated at the time verbally, and which were afterwards embodied in a letter addressed "*To the Tenantry of the Island of Islay*," and printed for private circulation. In this letter, among many useful suggestions, peculiarly adapted to the district, there occur the following, which afford good hints to other parts of Scotland also:—

"In many parts of the island I have observed that the plough is put into the ground too shallow. In general, the deeper the soil, the better the crops; but in some places it would be injurious to plough deeper, until the land is drained. Hurtful substances collect naturally in the under soil on many spots, but these substances are gradually washed out by the rains after the drains have been some time in the ground, and then the land may be ploughed deeper, without any chance of injury to the following crops."

"The presence of this hurtful matter in the under soil makes it better to stir it with the fork or subsoil plough a year or two before it is brought to the surface. To such of you as have not a subsoil plough, or have not horses enough to work one, the grape or fork is a tool which I would strongly recommend. It is so cheap that you can all buy it, you can all easily use it, and it opens up the subsoil, and therefore lets the water and roots down even more effectually than the subsoil plough. To open stiff clay subsoils, however, it ought not to be used for one or two years after the land has been drained, or else the soil will not be dry enough for the purpose."

"In your subsoils, in many parts of the island, a pan of bog-ore collects, which is very hard and difficult to break. It will in most cases require the subsoil plough to break through this pan, but when it is thoroughly broken, and the land completely drained, the soil will, by good management, be gradually brought to bear

profitable crops. Of this you may see some examples on Mr Webster's farm. When this pan rests upon a gravel, the fork may be used with great advantage in opening up the gravel below it.

"It struck me as a singular piece of waste at Port Helen, that the pot ales, the refuse of the distilleries from the first distillation, are allowed to run in large quantities into the sea. This liquid is not only a valuable drink for milk cows or fattening stock, but it forms also an admirable manure, especially when poured upon the compost heaps, or when mixed with the other liquid of the farm-yard. It ought not, therefore, to be allowed to run to waste."

"Among other things that are lost to your land are the bones produced upon the island. I understand that these are collected by a dealer in Bowmore and sent away from the island. They ought rather to be collected by yourselves, and broken small or dissolved in sulphuric acid, and thus applied to the land. They must be worth at least as much to you, if you farm well, as they are to the Renfrewshire or Ayrshire farmers to whom they are sent. I hope to see the day when the consumption of bones as a manure in your island will be sufficient to keep a bone-mill of your own in constant work."

The Committee have quoted thus largely from your Chemist's address to the Islay tenantry, in order to shew the Association the practical nature of the suggestions which he is in the habit of making when visiting districts with a view to improve the agricultural practices followed in them, and to express their satisfaction at learning that, in those districts which he had visited for this purpose, his services have been appreciated.

(5.) *Public Breakfasts at Dumfries.*

These Breakfasts were instituted for the purpose of affording an opportunity to persons frequenting the Highland Society's Show of discussing questions relating to agricultural improvement which were likely to be interesting to the farmers in the several districts in which the show might take place. It was thought, and, as it appears, correctly, that there are hundreds of intelligent agriculturists, at these great cattle shows, possessing a vast store of useful information, derived from their own experience and observation, on such occasions, who might be brought together, and induced to make known that information for the benefit of others. Each of the two breakfasts at Dumfries was attended by nearly [illegible]00 persons—the first of them being presided over by Sir William Jardine and the other by his Grace the Duke of Buccleuch.

'he following were the questions chosen for discussion by the ,ocal Committee for arranging the meetings :—

1. Furrow Draining—on what soils, and under what circumtances, it will cease to be profitable in Dumfriesshire and Gal-)way.

2. Advantages of keeping young store stock in equal condition hroughout the year—mode of doing so—expense and profit ompared with the present ordinary practice in Dumfriesshire ,nd Galloway.

3. Comparative value of grains, turnips, oil-cake, in feeding young cattle—quantities, qualities, used singly and mixed together.

The questions were opened on both occasions by Professor Johnston. A great number of proprietors, farmers, and land-stewards from all parts of Scotland took part in the disscussion of them. An English gentleman, who was present at the first of these breakfasts, writes as follows:—"I gained more practical information by the discussion upon draining than from anything else I either saw or heard at Dumfries. I think it most desirable if such meetings could be got up for the Royal English Agricultural Society at Newcastle next summer. When such a mass of people is congregated together, each may be able to convey something which would be of great importance to his next neighbour. Why not encourage such intercourse in every possible way?"

Here, probably, the Committee may be permitted to refer to the investigations set on foot at Dumfries in regard to the disease in the potatoes. This subject had frequently engaged the attention of your Committee of Management, and had also been specially recommended to their notice at a General Meeting of the Association. Accordingly, Professor Johnston had, with his assistants, when not otherwise occupied with analyses for members, been carrying on in the Laboratory a chemical investigation into healthy and diseased potatoes. The more, however, the subject was prosecuted, the more he found the extent and difficulty of the inquiry. Such was the state of matters, when, being present at the Committee Dinner at Dumfries, on the 7th of October, he was called upon by the chairman, his Grace the Duke of Buccleuch, to favour the company with any suggestions which occurred to him on points of practical importance. In the course of his address he alluded, among other things, to the prevalent disease in the potato crop, and to the expediency of devising some remedy, which, however, in his opinion, could not be successfully done till the nature, if not also the cause, of the disease had been discovered. He alluded to the premium of £50 offered by the Highland Society for analyses of diseased potatoes,

but which were not to be given in till the end of the year 1846. He urged the importance of a more immediate inquiry, and which should embrace the means of preserving the existing crop, both for present use and for seed in spring, and regretted that the Agricultural Chemistry Association, which was desirous of undertaking the whole inquiry, had not sufficient funds to enable it to do so in an adequate manner—an inquiry which, if extended to the whole country, might cost £500 to be effectually done.

After Professor Johnston had concluded his address, the croupier rose and stated that gentlemen at his end of the table were unwilling that this matter, which was almost of national importance, should be allowed to drop, and were anxious that a subscription should be at once set on foot in order to raise the necessary funds. This sentiment was cordially responded to, and an Irish gentleman who happened to be present (Mr Beamish of Cork) rose, and strongly enforced the propriety of immediately commencing a subscription, at the same time handing to the chairman a £5 note—an example which was very generally followed by the company.

The Committee have thought it right to mention these circumstances, as the erroneous impression prevails in certain quarters, that Professor Johnston was the person who proposed that a sum of £500 should then be subscribed, and, for this purpose, had sent subscription papers round the dinner table of the Highland Society's committee. This was done entirely by other parties.

The fund raised was placed at the disposal of three gentlemen who were proposed by the noble chairman, with the view of aiding this Association, as well as the Highland Society, in a thorough investigation of the question.

This Association has not the pecuniary means possessed by the Highland Society for promoting this or any similar inquiry which involves so much time and expense. The chief object of its institution was, as its rules shew, to afford to proprietors and farmers analyses at a cheap rate, and upon the accuracy of which they could depend—of soils, manures, and other substances; though, no doubt, it was intended also, if they had sufficient surplus funds, and the leisure of the Chemist admitted it, to carry on investigations bearing on the science and general interests of agriculture.

The investigation of the potato disease, considering the various opinions as to the nature, and still more as to the true cause, of it, was one which evidently would be prolonged and expensive, and which, therefore, could not be undertaken by their Chemist without being provided with the means of engaging an additional assistant in the Laboratory. The committee had not sufficient

funds to enable them to do so, but sufficient means are expected to be at the disposal of the trustees of the fund subscribed at Dumfries to effect this object, and when they applied to your Committee to sanction the prosecution of the analytical part of the inquiry in the Laboratory of the Association, all that they could do was to express their satisfaction at the stimulus given to an investigation in which the Association had taken much interest, and to authorize their Chemist to give his services in conjunction with the other gentlemen who had agreed to co-operate in following out the subject.

(6.) *Experiments by Practical Agriculturists suggested by the Chemist.*

In the course of his reports, founded on the analyses of soils and manures, Professor Johnston has taken frequent occasion to suggest experiments to be tried in the field, with the view of increasing the fertility of the soil. In fact, a report upon the analyses of a soil, as transmitted from the Laboratory, is little more than a detail of the experimental means which, as indicated by the analysis, should be adopted for improving that soil. A consideration of the mode in which a manure acts, also suggests experiments with the view of clearing up difficulties which present themselves.

The results of experiments made in consequence of such suggestions are not always of a nature to be laid before the public, though sometimes they are sufficiently curious to merit general circulation. Of this kind are some obtained at Barochan during the present summer, which the Committee have much pleasure in embodying in this report.

a. In an article on the solution of bones in sulphuric acid, inserted in the second part of the published Proceedings, p. 45, Professor Johnston, in stating that the good effect of bones depended in part upon the bone earth and in part upon the gelatine they contained, suggested, as a curious experiment, that old shoes, of which no use is ever made, might be dissolved in sulphuric acid, and applied to the land with the prospect of advantage. He, at the same time, wrote to Mr Fleming of Barochan, a county member of your Committee, proposing that he should try the experiment in various forms.

Mr Fleming and his overseer, Mr Gardiner, took the matter up with their usual zeal, and upon a piece of newly-trenched land, which they afterwards sowed with turnip seed, they made the following experiments with the annexed results:—

No. 1. Farm-yard manure.—Good crop.

No. 2. Old shoes, 5 cwt. per acre, dissolved in half their weight of sulphuric acid.—Scarcely a plant.

No. 3. Glue, 5 cwt. dissolved in half its weight of sulphuric acid.—Scarcely a plant, and those which came up were stunted.
No. 4. Glue, 5 cwt. dissolved in hot water, per acre.—No crop.
No. 5. Old shoes, 2½ cwt. per acre; animal charcoal, 2½ cwt. per acre, mixed and dissolved in sulphuric acid.—A good crop, equal to No. 1.
No. 6. Glue, 2½ cwt.; animal charcoal, 2½ cwt. dissolved in sulphuric acid, per acre.—A fair good crop.
No. 7. Glue, 2½ cwt. dissolved in hot water, and 2½ cwt. animal charcoal, per acre.—Fair good crop.
No. 8. Animal charcoal, 5 cwt. alone.—A fair good crop.
No. 9. Nothing applied.—Light crop, small bulbs and tops.

The hasty drawer of inferences would conclude from Nos. 2, 3, & 4 of these experiments, that neither old shoes nor glue, whether dissolved in water or in sulphuric acid, are of any use to vegetation, Even when by mixing half the quantity of these with an equal weight of animal charcoal (the refuse bones of the sugar refiner) a fair good crop was obtained, equal to that yielded by farm-yard dung, he would still be inclined to attribute all the virtue to the earthy phosphates contained in the animal charcoal. But, when in No. 8 it appeared that 5 cwt. of the animal charcoal gave no better crop than half that quantity when mixed with an equal weight of glue or of old shoes, it seems impossible to deny that some fertilizing virtue must exist in the gelatinous matter of glue, and of the dried and tanned skins of animals. It illustrates, in fact, what is a leading principle in the modern doctrine of manures, that where substances applied *alone* may fail, the application of two or more *together* may produce very striking effects. So also in this case the gelatine produced little effect until it was conjoined with the earthy matter of bones contained in the animal charcoal.

Still there is a curious anomaly in these experiments, which shews how repeatedly our experiments must be made, and how open we must keep our minds to new opinions. The crop was actually worse when the glue and the dissolved shoes were applied alone than when nothing was put into the soil. This might possibly arise from their being applied in a wrong way. They ought to have been made into a compost, and fermented, before they were applied. At all events, the experiments must be repeated and varied before anything which can be depended upon as true to nature can be extracted from them.

6. Among other experiments also, of which circumstances may justify a notice in this report, are some made upon potatoes by

Mr Campbell of Craigie, a zealous member of the Association, with the view of determining the effect of different manures in preventing failure or disease in the potato crop. These experiments and their results are thus stated by Mr Campbell himself.

"The potatoes were planted on the 16th April 1845, all Rough Reds, on drills 16 feet in length. The manure employed, and the number of diseased potatoes in each drill when they were taken up, was as follows:—

"No. 1. Manured at the rate of 48 tons farm-yard manure to the acre—only 1 diseased, 3 at the shaw.
"No. 2. Manure the same, but seed planted whole—18 diseased.
"No. 3. 14 tons dung to the acre, 4 ounces guano, 4 ounces charcoal, 2 ounces sulphate magnesia—6 diseased.
"No. 4. 14 tons dung per acre, 4 ounces guano, 4 ounces bones, 2 ounces Epsom salts, 2 ounces sulphate of soda—13 diseased, 110 good.
"No. 5. 5 ounces guano, 5 ounces bones dissolved in sulphuric acid, 2 ounces sulphate of soda—9 diseased.
"No. 6. Vegetable mould, (decayed wood,) 5 ounces of carbonate of potash of the shops, 3 ounces of soda of the shops, 5 lime, 1 sulphate of magnesia, 2 of bones dissolved in sulphuric acid, 2 alumina—125 good, 28 bad.
"No. 7. Vegetable mould, 2 ounces potash of the shops, 1 do. of soda, 2 of lime, ½ ounce of sulphate of magnesia, 1 of alum —9 bad, 96 good.
"No. 8. Gas water, compost of weeds, &c., 2 ounces potash, 2 of soda, both carbonates of the shops—7 bad, 102 good.
"No. 9. Very old decayed dung, 5 ounce lime—41 bad, 56 good.
"No. 10. Bones dissolved in sulphuric acid—29 bad, 52 good.
"No. 11. No manure, potatoes small—4 bad, 85 good.
"No. 12. No manure, but watered with spring water in dry weather—5 bad, 70 good.
"No. 13. Planted in a patch of weeds about 3 feet long, without any soil but what had stuck to them in gathering—19 bad, 15 good, no manure.

"All the potatoes were planted whole, except Nos. 1, 11, and 12; drills, 30 inches distant, 9 and 10 at different parts of the field from the others, in shade of a hedge.

"I am told by my gardener, a very intelligent man, that in no case has there been any disease where the shaws have been trodden down, of which there have been many instances in gardens.

He also says that quick lime has been found to stop the disease; it dries up the sore, and it comes off like dross.

"I have ordered a quantity of bad potatoes to be treated with quick lime. I wish those who have the means, would plant in pots some of the diseased potatoes, after they are completely dried, with proper manure, and place them under glass to see if they will vegetate."

c. Besides these gentlemen whose experiments have now been adverted to, the Committee beg to state that there are many subscribers who have been, or are, carrying on experiments of various kinds, in communication with your Chemist, but who have not yet reported the results in any formal manner, either to him or to the Committee.

One of the Committee, (Mr Aitchison of Drummore,) reports as follows:—"I am well aware, from my own experience, of the advantages I have already derived from the Association, and especially from the new views opened up, and suggestions made by its Chemist, on manuring and on the feeding of cattle. I am now carrying on a good many experiments, in consequence, on these two branches; but they are not yet sufficiently matured to be made public, agricultural experiments taking a long time before being perfected. There are many farmers in my district who are doing the same; and, in the course of a short time, I have no doubt that agriculture will derive much benefit from the institution of our Association."

(7.) *Quarterly Publication of the Proceedings of the Association.*

It was reported to the last General Meeting, that an arrangement had been made with the Highland Society for the publication, in their Transactions, of periodical accounts of the Proceedings of the Association.

These publications were resorted to with the same view which suggested the establishment of Monthly Meetings, viz.—the giving of periodical and frequent information to members of the Association and the public, of what was doing, not only in affording to subscribers analyses and advice in their individual cases, but in furthering the art of husbandry generally. They afford to the Chemist a convenient opportunity of shewing the important additions which are made to the science, and of answering, in a formal and precise manner, any questions of general interest submitted to him. Several such questions will be found to have been answered or considered in those parts of the Proceedings already published.

Three of these publications have now appeared, and the Com-

nittee appeal with confidence to them, as containing irrefragable roofs of the activity of the Association, and of the good which t is doing. They shew also the readiness with which intelli- ent agriculturists, both proprietors and farmers, are carrying on xperiments, in order to improve and economize existing means, nd to discover new methods of improving their soils, and new ood for their stock; and they testify to the growing conviction f practical men, that it is by the aid of chemical analysis that heir art is hereafter most likely to be promoted.

These quarterly accounts of the Proceedings of the Association xtend in each case to from twenty-four to thirty-two octavo pages, nd hitherto have been drawn up, revised, and corrected for the ress, by your Chemical officer alone. This duty, which neces- arily occupies much time and thought, though not originally sti ulated for when Professor Johnston was engaged, he has hitherto erformed entirely himself. It is proposed to appoint a small Sub-Committee to assist him in the performance of this important luty.

The Committee, with the view, among other things, of circu- ating these quarterly accounts of the Proceedings of the Associa- ion among its country members, in the spring of last year ppointed a number of local secretaries in different parts of the ountry. One thousand copies of each part were thrown off for listribution in this way; but the Committee find that these opies had been omitted to be dispatched, and that, in point f fact, not more than one hundred copies have yet got into he hands of members. The Committee have now made arrange- nents by which in future these parts will, as soon as printed, e sent to the local secretaries for distribution. They learn rom their present Honorary Secretary, Mr Horne, that twenty opies of each of the three Parts now printed have been, or are bout to be, sent to all the local secretaries, for distribution mong those members entitled to receive them.

II. The Committee will now proceed to the second head of heir Report, viz., the present state of the Association.

Under this head they will draw attention to the following oints:—

(1.) Number of Members.
(2.) Amount of Subscriptions and State of Funds.
(3.) Expenses of Laboratory.
(4.) Constitution of Committee of Management.
(5.) Duties of Local Secretaries.
(6.) Resignation of Mr Coventry as Honorary Secretary, and appointment of Mr Horne.

These points will be noticed successively.

(1.) *The Number of Members is at present* 709.

The Committee intend to take steps with the view of obtaining a further accession to the number of Members, by issuing a circular inclosing a copy of the Rules and names of Subscribers, and of this Report if approved of. No appeal has as yet been made by the Committee to the agricultural body generally for support, in which respect they have been perhaps somewhat to blame, but they thought it better to delay their appeal till they could, in support of it, refer to two years' Proceedings of the Association, and they trust that they are now to make this appeal with every probability of success.

(2.) *Amount of Subscriptions and State of the Funds.*

From a very distinct and accurate Report on the funds, made by Mr Horne, it would appear that, for the two years preceding 11th November 1845, the subscriptions amounted altogether to £1762, being, on an average, £881 yearly.

By the arrangement with Professor Johnston, when he was engaged as Chemist of the Association, he is entitled to 5-6ths of the yearly subscriptions, leaving the remaining 1-6th to the Committee, which at the outset was expected to be more than sufficient to pay for the stationary, printing, and other ordinary expenses—and so it has proved to be; for, after paying expenses incurred by the Committee, amounting to £279 : 18s., they have on hand a balance of £34.

But this balance would have been four times greater had it not been for a debt of nearly £150, incurred before your Chemist was appointed, and which arose out of the proceedings resorted to for establishing the Association. The ordiary annual expenses of the Committee do not at present exceed £80, even after printing 1000 copies of each part of the Proceedings of the Association, which they have latterly resolved on, whilst the average income of the Committee has been about £157. Even though the annual subscriptions do not increase, (though there is every reason to expect that they will,) the Committee hope to be able, out of their share of the funds, to promote in other ways the objects of the Association. One purpose to which they wish to apply a portion of their income is the appointment of a paid or permanent Secretary, from whom the Committee may without scruple, exact the performance of the various duties [illegible] some of them now pretty laborious, which attach to the office. Farther, there are those analytical investigations on quest[illegible] general interest already alluded to, which, being [illegible] considera[illegible] expense, and requiring a

lengthened period for their completion, could not be expected to be instituted at the cost of any individual member, but which might very fitly be undertaken by the Committee. For example, some of the most common articles of agricultural produce have not yet been correctly analysed. The Directors of the Highland Society state, in their last list of Premiums, that "little is yet known of the true composition of *oats*," the most common of all our grains; and, accordingly, they offered a premium of £50 for an "analytical examination of that grain" alone—a fact which shews the opinion of that body in regard to the labour and expense attendant upon such investigations; and they understand that the gentleman to whom, only a few days ago, this Premium was adjudged by the Directors of the Highland Society, was engaged for more than a year in this chemical investigation.

It is also satisfactory to the Committee to add that this lengthened investigation was made in the Laboratory of the Association under the immediate direction and superintendence of their Chemist, and, therefore, may be considered as part of the analytical work performed in the Laboratory during the past year.

But, if an accurate analysis of the healthy grain is so tedious and expensive, how much more so must be that of the diseased grain? and hence, no proper chemical examination has yet been made of the smut which so often affects the oat crop, or of the similar diseases affecting the wheat crops. These would afford proper subjects of inquiry in the Laboratory of the Association, and which the Committee would very willingly cause to be taken up had they the necessary funds to pay for the additional assistants who, for these new trains of research, would require to be employed. The present state of the funds, now that the debt has been paid off, will enable the Committee to do this.

(3.) *Expenses of the Laboratory.*

The expenses of the Laboratory, during the year 1844, amounted to £505. This included a considerable outlay for fittings, not likely to occur on any succeeding year. But the increasing applications for analyses by members has rendered it necessary for your Chemist to engage, of course at his own expense, an additional number of assistants.

Mr Johnston originally undertook to have two assistants in the Laboratory during his own absence in Durham. He has now five constantly employed.

This has necessarily added to his expenses, which even for the present year amount, including house-rent and taxes, &c., to £498 : 6 : 6. This sum consists of the three following items:—Salaries to chemical assistants, amounting to £295 : 1 : 6; Expenses in the Laboratory, amounting to £191 : 4 : 11; and Expenses connected with attendance on the Dumfries breakfasts, amounting to £12. Against this outlay is to be placed the sum received in fees for analyses, which, however, from the low rates of charge originally fixed by the Committee, fall, as usual, greatly short of the expenses. For the past year, they fall short of the expenses by £186 : 4s., which, of course, diminishes, by that amount, Mr Johnston's share of the subscriptions. In this way his whole income for the year 1845 has been as follows:—

	1845.		
Share of Subscriptions and Fees for Lectures, ...	£621	1	5
Deficiency as above, ...	186	4	0
Clear income,	£434	17	5

Looking to the amount of laborious and responsible work performed by your Chemist during the past year, in analyses, lectures, reports, correspondence, and excursions, and to the inquiries carried on by him at his own expense, the Committee do not think £434 will be considered as more than adequate remuneration to a gentleman of Professor Johnston's eminence as an Agricultural Chemist—while it is certainly less than was originally looked for. But when it is farther considered that this is not a fixed salary — that, in fact, he is guaranteed in no sum whatever, and depends entirely on the precarious and fluctuating subscriptions of members, who can say that Professor Johnston is adequately remunerated for the duties performed and the risks incurred by him as Chemist of the Association? Among these risks, exposure to actions of damages for advice given to members of the Association should not be lost sight of. During the last six months, an action was raised against the Professor for an opinion given by him at one of the Monthly Meetings as to the value and use of an English artificial manure, the effect of which was alleged to be a depreciation of the price of the compound, and for which damages to the extent of £10,000 were claimed. Professor Johnston offered to make for the patentees, in order to verify his opinion, a minute analysis of the substance, provided they would agree to publish the same. Since that offer, he has heard no more [illegible]

(4.) *Constitution of the Committee.*

the Rules of the Association, three members go out every by rotation, unless otherwise arranged among themselves, of whom is selected by the Highland Society from among own Directors, and the other two of whom are elected by members of this Association at a General Meeting.

e two oldest members of Committee on the list are Mr Finnie and Mr Alexander of Ballochmyle.

e Committee, in conformity with the usual practice of re-nending to the General Meeting the persons who should be inted to supply the vacancies, suggest Mr John Girdwood, er, Corstorphine, and Dr K. Greville, F.R.S.E., both of 1, in the event of their being elected, have agreed to attend Meetings of Committee regularly.

e Highland Society, at their General Meeting yesterday, inted Mr J. A. Dalzell of Whitehouse (in place of Mr Hog ewliston) as one of their three members representing that ty in this Committee.

regard to County Members of Committee, of whom there now eight, the rules are defective, in not defining the d for which they are to remain members. Nor are the nittee disposed to recommend a limitation of the period, ded only they attend the Meetings of Committee; but they 1 suggest that, if, prior to the 1st of November in any year, ill be found that a county member does not attend one-h of the number of Committee Meetings which have then a place, he shall, unless the Committee see occasion to decide wise, be held to have forfeited his right to remain a county ber. The mode in which the Committee propose that county bers should be elected they will explain under the next head.

(5.) *Duties of Local Secretaries.*

iere are now thirteen Local Secretaries residing at the fol-ig places:—

r Simpson, at Beauly, near Inverness.

r Wood, Banker, at Colinsburgh, Fifeshire.

r M'Nab, Secretary to the South Argyle Agricultural ety.

r Turnbull, at Bonhill, near Dumbarton.

r M'Murtrie, Secretary to the Ayrshire Agricultural Society.

r Crauford, Secretary to the Lauderdale Agricultural ety.

r Brown, Secretary to the Morayshire Farmers' Club.

r Longmore, banker, Keith.

r Goodlet, at Grantsbraes, near Haddington.

r Patullo, writer, Dundee.

Mr Robert Elliot, farmer, Hardgrave, by Ecclesfechan.
Messrs Fullarton & Collier, (jointly,) near Brechin.
Mr Martin, Secretary to the Renfrewshire Agricultural Society, Paisley.

The Committee are sorry to admit that, though these gentlemen were appointed in the course of last winter and spring, there has been little or no communication with them, and they take blame to themselves for not having intimated to them the duties they would be expected to perform. The Committee propose that it shall be part of the duty of the Local Secretaries,

1. To circulate among the members of the Association in their several districts copies of the published accounts of the Proceedings of the Association sent to them by the General Secretary.

2. In the case of counties in which the resident subscribers are entitled to elect a county member, to consult them—in the event of a vacancy—as to the appointment of a new member, and after obtaining their opinions, to make intimation to the General Secretary, on or before the 1st December of any year, in regard to the individual subscriber chosen.

The Committee may here add that they are desirous of obtaining the services of Local Secretaries in other counties, in which there are Members whose united subscriptions amount to upwards of £20, and which are, therefore, entitled to elect a Member of Committee, and they will be very much obliged by receiving recommendations of persons to hold these appointments who are likely to take an interest in promoting the objects of the Association.

(6.) *Resignation of Mr Coventry, and appointment of Mr Horne, as Honorary Secretary.*

This gentleman's resignation was given in to the Committee, and accepted of by them in the course of last autumn. On that occasion the following resolution was unanimously passed—"A letter having been read from Mr Coventry, resigning the offices of Honorary Secretary and Treasurer, the Committee, in accepting the same, resolved to record in their minutes the high sense they entertained of the very valuable services he has rendered to the Association from its first establishment up to the present time, and to offer to him in their own name and in that of the Association their cordial thanks for these services; and further, the Committee recommend to the next General Meeting of the Association, to adopt a resolution to the same effect.

On the suggestion of Mr Finnie, Mr Donald Horne was appointed by the committee as Interim Honorary Secretary; and having been waited upon by Mr Finnie and Mr Coventry, in order to make known to him and support the wishes of the

Committee, he intimated to them his acceptance of the appointment.

Mr Horne has since continued to discharge the duties of the office, and the Committee feel much indebted to him for having so readily complied with their request, and attended so zealously and effectively to the business of the Association.

It may be proper here to mention, that the Committee have lately put on a better footing the collection of the annual subscriptions. They have arranged that Mr Young, the gentleman who had been employed by Mr Coventry to engross the minutes and dispatch the notices of meetings, for which he received £12 annually, should also collect the subscriptions; and that the whole of these duties shall be performed at a per-centage on the sums collected. Professor Johnston having readily agreed that this salary shall affect his share of the subscriptions, which was formerly not the case, the Committee expect much advantage from this arrangement.

III.—Utility and Prospects of the Association.

Under this last head of their report, the Committee will draw attention to the following points :—

(1.) Utility of the Association.
(2.) Estimation of the Association at home and abroad.
(3.) Increasing business of the Association.
(4.) Prospects of additional Members.

In reference to the first of these points, viz., the utility of the Association, the committee would observe that, short as is the period during which the Association has existed, it has already done much to promote the two great objects for which it was designed. These objects are, *first*, the diffusion of a knowledge of the principles of agricultural chemistry; and, *secondly*, the application of these principles to aid the farmer, especially by means of analyses in the prosecution of his art.

The first of these objects was by the rules directed to be promoted by means of verbal expositions, addresses, and correspondence. Such means accordingly have been resorted to for making known, in every part of Scotland, the importance of those scientific principles on which a rational agriculture must be based, and of taking the aid of chemical analysis in the cultivation of the soil. Altogether, the Chemist has, during the last two years, delivered about 70 lectures, independently of the breakfasts and dinners attended for a similar purpose. These lectures have been given in nearly all parts of Scotland, in some even of the most remote, and were delivered to audiences composed chiefly of

farmers. The public ordinaries which generally accompanied these lectures the Committee consider most useful as affording to practical men an opportunity of communicating the fruit of their own experience, and to your Chemist of shewing the application of science to the daily operations of the farm. By these lectures, and other means adopted by the Committee, the great mass of the agriculturists of Scotland have been made, at all events, better acquainted with the principles of Agricultural Chemistry, or have been embued with a stronger conviction of its usefulness and a taste for the study. One proof of this is to be seen in the number of agricultural periodicals which have sprung up in Scotland since the Association was established, and a still more decisive proof is afforded by the arrangements made by schoolmasters in very many parts of the country to teach the principles of Agricultural Chemistry. If the schoolmaster undertakes to teach this branch, it is because the farmers and proprietors of his neighbourhood desire it, and consider it is likely to be useful to the rising generation of practical men.

The second leading object of the Association, viz., the application of chemical analysis to aid the farmer in the prosecution of his art, has also been realized by a very great number of the subscribers. In proof of this, it is only necessary to advert to the fact that nearly 1000 analyses have been made in the Laboratory of the Association during the two years which have elapsed since the business of the Association began, and that the transmission of these analyses has generally been accompanied by opinions or advice of a practical nature, which the analyses were fitted to suggest. From such a body of analyses and opinions, scattered over the country, much good cannot fail to have been effected, in illustration of which the Committee may quote the following letter from a Lothian farmer—

" The advantages which I myself have derived from the operations of your Agricultural Chemistry Association, during the past season, have been very considerable. Leaving out of view the security with which I can now make my purchases of the ordinary fertilizers, through the check afforded by the Association, I may mention an instance in which I was saved from considerable loss in reference to a new substance lately advertised and sold as a manure; but the name of which I, for obvious reasons, do not wish to state publicly. Having resolved to purchase a considerable quantity of it, I took the precaution of applying to Professor Johnston before doing so, who at once made me aware of its nature, and pointed out how I might myself prepare the same substance at a very trifling expense. I cannot

estimate the value of the information, in this one instance, at less than £20.

"Again, I have been in the habit of using a refuse substance which I found afforded a cheap and excellent manure for green crops; it had this defect, however, of destroying or greatly injuring the succeeding white crop, by raising a soft straw and a very poor and shrivelled grain. I have now had this substance analysed, and the cause of its defective operation pointed out, and such advice given me as, I have no doubt, will enable me easily and effectually to remove the objections to its use in a succeeding year.

"In addition to the instances I have particularized, I have derived very great benefit from the advice of the Professor relative to the application of saline substances under particular circumstances to my bean crop. The resulting crop is not yet thrashed out, so that I cannot state precisely the profit of the application: judging from appearances, it cannot be less than 30s. per acre. I therefore consider my annual half guinea as very profitably invested.

"The advantages which have resulted from the institution of the Association are also evident in the greatly accelerated march of improvement throughout the country. Agriculturists are now beginning to understand better the nature of the materials with which they work and of the crops they rear from them. I have no doubt that the day is not far distant when an intelligent agriculturist will, on entering to a farm, obtain correct analyses of his soils and subsoils, of the manures he uses, and of the crops which he rears. In this way he will be able to keep such a *Dr.* and *Cr.* account between his soils and manures on the one hand, and his produce on the other, as will enable him to know what substances to apply, so as, with the assistance of the mechanical improvements of the soil, to produce an amount of animals and vegetables from a certain breadth of land which even the most sanguine hardly dares to hope for.

"I cannot close this letter without bearing testimony to the pains-taking way in which Mr Johnston has always afforded me his advice, when applied for in various important instances besides those I have related above."

The Committee believe that a large amount of similar testimony might be obtained from subscribers who have benefited by the analyses and advice obtained from the Association.

But the practical benefits resulting from the analyses made for particular individuals have not been confined to the parties themselves for whom hey were made. Those results which appeared to be of general utility to agriculture have been

made widely known to members and the public at large, either through the Monthly Meetings in the Laboratory or through the quarterly publication of the Proceedings of the Association.

The utility of the Association is farther proved, not merely by the amount of valuable information given, but by the imposition which it has checked. On the one hand, it has given to the farmer new means, or improved the old means, of producing his crops or feeding his stock; and, on the other hand, it has protected him from the frauds which otherwise might have been practised upon him. In what other way can it be explained that, whilst in England there have been quantities of spurious manures palmed off on the unsuspecting farmer, in Scotland, with one exception, there have been no such cases. The generally known fact that the Scottish farmers and landlords established for themselves an Association chiefly for the purpose of enabling them to obtain a minute and accurate analysis from a chemist highly skilled in his own profession was sufficient to prevent the practice of such frauds on this side of the Tweed.

In connexion with the manufacture and adulteration of manures, your Committee have much satisfaction in adverting to another point.

It seems now pretty generally recognised that the time will soon arrive when agricultural chemists will be able to say what things are essential to the growth of this or that crop, and what, therefore, ought to be added to a soil which is deficient in this or that ingredient, in order to make it grow a particular crop? In other words, the analytical chemist will be able to prepare a set of recipes, according to which the farmer will compound all the artificial manures he requires. Such a set of recipes your chemist is now engaged in preparing, and some of them, it is hoped, will appear in an early number of the Proceedings.

But, besides the recipes, the farmer requires skilful and conscientious persons to compound them—who shall mix together the pure materials in the right proportions and in the right way—who shall, in short, guarantee the composition of the mixtures they make up. The Committee are happy to announce that a proposal has been laid before them for the establishment of an artificial manure company, the object of which is to prepare and sell *known* mixtures only, and to guarantee the compounding of them. Of this proposal the Committee have expressed their approval—being satisfied that the farther our artificial manures are removed from the risk of adulteration, the more confidence will the public place in them, and the more reliance will scientific men be justified in placing on experiments made with them in the field.

In these circumstances, it cannot be doubted that proprietors

and farmers, who are members of this Association and who avail themselves of the analyses and advice which its Laboratory and Chemical officer afford, and even agriculturists in Scotland generally, are deriving much practical good, and are likely to derive more, from its establishment, and that the science of agriculture is also, from time to time, receiving important additions.

But the utility of this Association is not confined to agriculture, though it was for its advancement solely that it was originally established. Its benefits have been felt by other interests also.

The Committee here, in explanation, refer to the discovery by your Chemist that the slag of the iron-melting furnaces, the refuse of the prussiate of potash manufactures, bleach-fields, sugar refiners, soap, alkali, and other chemical works, contain substances of a highly fertilizing character, and which, in consequence of advice given by him, are now used for the purpose of manuring the land, with equal advantage to the manufacturer and to the cultivator of the soil.

One of the latest discoveries of this kind was made in regard to a bleach-field near the estate of Sir John Ogilvie, a member of your Committee, and the refuse of which bleach-field, lying in large waste heaps, was to be had for nearly a nominal price. Sir John, conjecturing that in this refuse something valuable to the agriculturists might exist, sent a portion of it to the Laboratory of the Association for analysis. It was found to contain about 14 per cent. of alkaline matter, and 55 per cent. of carbonate of lime, the discovery of which, of course, led Professor Johnston to recommend the use of this refuse as likely to be beneficial in preparing the land for green crops or as a top-dressing for grass and clover.

The discovery thus made proved ultimately even more beneficial to the owner of the bleach-works; for, on learning that so large a proportion of alkali existed in his refuse, he immediately took steps to have it more thoroughly washed before throwing it away, and the result was, that, instead of containing fully 14 per cent. of alkali, a sample of refuse of this bleach-field, subsequently sent, was found to contain only 8 per cent. and the additional care now bestowed upon it has probably still farther diminished this quantity. Notwithstanding this, however, your Chemist reports that the refuse in question will be of much use to the farmers in the neighbourhood, and in the third part of our Proceedings he has published a letter shewing its good effects on the turnip crop, as shewn by experiments made in other parts of the empire.

In the same letter the writer refers also to another manufac-

tory refuse, viz., "muriate of lime," which he had used most effectually for fixing the ammonia of stables and dung-hills, and for mixing with guano. It is made by a soda manufacturer, who, wishing to obviate the injurious effects of the muriatic acid escaping by his chimneys, contrived a chamber, containing lime in a continual state of moisture, and into which the gas is conducted, instead of being, as formerly, carried up the chimney and escaping. This refuse, till taken by the farmer, yielded no profit, and rather entailed expense on the manufacturer.

In the third part of the Proceedings of the Association, just published, there is an analysis of the water in which barley has been steeped preparatory to its being made to sprout, and which, after serving its purpose, is always allowed by the maltster to run to waste. Professor Johnston has found that this water "contains much valuable matter likely to promote the growth of plants. The organic substances in it are capable of supplying organic food; the inorganic substances (alkaline salts and phosphates) are in a state in which they can readily make their way into the roots of plants. It ought not, therefore, to be allowed to run to waste wherever it can conveniently be applied to the land." Mr Houston of Johnstone Castle has this season applied it to his oat crop, and with marked good effects.

After these proofs of the valuable nature of the investigations in the Laboratory of the Association, who will not most cordially concur in a remark in one of your Chemist's recent reports, when treating of the agricultural uses which can be made of sulphuric acid, "that the extended use of this article, creating, as it must, an increased demand for the raw materials from which it is manufactured, exhibits another illustration of that intimate connexion which, in a country like ours, must always, in a healthy state of things, exist between the agricultural, the manufacturing, and the mining interests, and of the certainty with which the advancement of the first of these interests must lead to the greater extension and prosperity of every other department of the national industry?"

The foregoing details under this head will, the Committee doubt not, be considered as affording abundant proofs of the utility of the Association, and not to agriculturists only, but also to other important interests.

(2.) *Estimation of the Association at Home and Abroad.*

In regard to the opinions of our own agriculturists of the usefulness of the institution, it might be sufficient to refer to the number of its members, which is still on the increase—to the

fact that several Agricultural Societies (including the Highland Society) contribute to its funds—and to the good wishes for its prosperity expressed at public meetings of an agricultural character.

The Committee, however, would, in addition to this general evidence, refer to some special testimonies to the usefulness of the Association which have lately been sent to them.

The Committee quote with much pleasure the following letter which one of their number has received from a member of the Association in Glasgow, well known for his intelligence and business habits :—

"GLASGOW, *5th January* 1846.

"MY DEAR SIR,—Assuming that it will be agreeable to the Directors of the Agricultural Chemistry Association to learn the sentiments of members as to the usefulness of our society, I take the liberty of troubling you with a few remarks, as I cannot attend the General Meeting which I see advertised for the 14th.

"The first practical benefit I received from the Association was by an analysis of guano, which I bought *here* by sample from *Liverpool.* It turned out that the stock was not equal to the sample, and the result was a saving to me of a considerable sum, which the seller readily agreed to deduct, upon learning from whom I had got the analysis.

"Soon afterwards a patent article was recommended to me, which was to improve the quality of sugar, and do away with the use of lime in its manufacture. I was aware that this article was used to a considerable extent; but having doubts as to its value, I got it analysed at your Laboratory, and found that what I was paying an exorbitant price for was nothing but burned gypsum. This information, of course, put an end to the imposition. I might add many such proofs of the utility of the Association, were it necessary; and, although not a British farmer, it is evident that every one of that class, who thinks proper to join the society, has it in his power to make the same use of the Association that I have done.

"The greatest benefit which I have received, however, from the advice of our Chemist, is with regard to the cultivation of estates in Demerara. I inclose a copy of a letter addressed by our Chemical officer to me some months ago, which I do believe has done more to open the eyes of people in the West Indies than anything else; at least, so far as regards the improvement of the soil. Lime is there being applied extensively, in consequence of the recommendation, and in the way suggested in this letter, and with extraordinary results. I believe I am correct in stating that its use had not

before been tried or even thought of. Tile draining is also being introduced, as suggested in that letter, and, indeed, every kind of improvement. I attribute much of the spirit which has been awakened to the writings of your Chemical officer; and, as a proof of the value which people there entertain of his peculiar science, I may mention that the services of Dr Shier of Aberdeen have just been secured for the colony, and that other colonies are following the example. Surely chemistry applied to agriculture must be as valuable to the farmer at home as it is now proving to our West India planters.

"I cannot conclude this hasty note without expressing the gratitude I feel to Professor Johnston, not only for the real benefit I have received by attending to his advice, but by the kind and agreeable manner in which he has communicated it.—I am, my dear Sir, yours faithfully, MUNGO CAMPBELL, jun."

The Committee may add that Professor Johnston's letter referred to by Mr Campbell, was printed by the latter gentleman for circulation among his West India friends, and has been extensively distributed.

In regard to the opinion entertained of the Association elsewhere than in Scotland, the Committee would refer to several circumstances of a gratifying nature which have occurred.

Within these few months steps have been taken to establish in the north of Ireland a society to be called the "Chemico Agricultural Society of Ulster," expressly founded on the Scotch Agricultural Chemistry Association as its basis. In the prospectus issued by the promoters of this new society, published in the newspapers, it is stated that, "from a thorough conviction of the value of chemistry in its application to agricultural objects, a number of individuals in the northern counties of Ireland are now disposed to associate, for the purpose of promoting the cultivation and diffusion of this most useful and interesting branch of knowledge. Were any example," it is added, "requisite to justify a project of such undeniable utility, reference might be made to a society with like objects, which has been for two years in active operation in Scotland, under the able superintendence of Professor Johnston. The advantages thence resulting would be found amply sufficient to warrant the establishment of a similar institution in this country, where a scientific mode of farming is comparatively of rare adoption."

The intended proceedings of this Irish society appear to be precisely similar to ours, viz., the analysis of soils and manures—the making of experiments suggested by the Chemist, the result of which shall be recorded and published in periodical tracts, for

the information of members—and the giving of lectures by the Chemist at the meetings of local agricultural societies.

The Committee cannot but feel gratified at finding that the principles and proceedings of this Association have met so cordially with approval on the part of the intelligent agriculturists of the north of Ireland. They are happy also to learn, from a recent communication, that most of the noblemen and large proprietors in Ulster have joined the Irish Association, and they trust it will meet with that permanent success which they are convinced its objects deserve.

The Royal Agricultural Society of Jamaica, intimated, twelve months ago, an earnest desire to participate in the privilege of obtaining analyses from the Laboratory of the Association. To this, however, many difficulties presented themselves. The result of this was, that they have resolved to obtain two chemists for themselves, and, accordingly, they are sending to this country two young men to be instructed in the Laboratory of the Association, and, to shew their good will towards our Association, the Royal Agricultural Society of Jamaica has subscribed £6 : 6s. annually towards our funds.

(3.) *Increasing Business of the Association.*

The analytical business of the Association during the past year has increased very largely. The number of analyses made during the first year, 1844, amounted to about 330, during 1845, they have, as already shewn, amounted to 672, being at the rate of more than double those of the previous year. This has rendered necessary a corresponding increase of the number of assistants in the Laboratory, and should the analytical work go on increasing in quantity, the number of assistants must be still further augmented.

(4.) *Prospect of Additional Members.*

The Committee have every reason to believe that, the more the objects and proceedings of the Association become known, the more support it will obtain. There are two great classes in the country from whom this support may be expected, viz.—those who wish to obtain for themselves the advantages it confers, and those who generously desire to support it for the good of others.

To this last class belong many who are already members of the Association, and who, though contributing a yearly subscription, seldom or never avail themselves of the privileges it offers them.

It is in this way that the expenses of the Laboratory are paid,

for it has already been shewn that the fees of analyses would not nearly meet the expense of making them.

The Committee cannot doubt that, when the landed gentry of the country become fully aware of the advantages resulting from the institution, and especially to the practical agriculturist who tills the land and pays the rent, that they will come forward as handsomely as others of their class have already done, whose names are enrolled in our list of members. During the last six months upwards of twenty new members have joined the Association, and have signified their desire to support it, and, among others, the Dukes of Hamilton and Montrose, the former of whom has given a subscription of £5 : 5s. beginning with the commencement of the Association; and when the Committee have taken the steps at present in contemplation for making a direct appeal to agriculturists throughout the country, both proprietors and farmers, they cannot doubt the accession of a large additional number of members.

D. HORNE,
Hon. Sec.

ON THE ELECTRO-CULTURE OF FARM-CROPS.

By William Sturgeon, Lecturer at the Manchester Institute of Natural and Experimental Science. Formerly Lecturer on Experimental Philosophy at the Hon. East India Company's Military Academy, Addiscombe. Author of "Lectures on Electricity" and "Lectures on Galvanism." Editor of the "Annals of Electricity, Magnetism, and Chemistry," &c.

In offering to the public this essay on a subject of inquiry so highly interesting in its character, and at the same time so perfectly novel in practice as is the Electro-Culture of Farm-Crops, I feel myself peculiarly, and not very enviably, circumstanced, by undertaking the advocacy of this mode of culture against the generally unfavourable opinion of it at this time prevailing, in consequence of the numerous reports, extensively circulated, of an almost, if not a total failure attending the numerous experiments that have been attempted during the present year. Moreover, the unpropitious views consequent thereon, amongst those who have *partially* entered on the experimental part of the inquiry, have to be assailed and corrected by a scientific train of reasoning, to which farmers, and other interested parties, are probably not much accustomed; and there are also to be encountered those hostile prejudices, deep rooted in the minds of others, who consider themselves qualified to judge from their theoretical knowledge alone.

The essay, however, is undertaken for the sole purpose of stimulating farmers and other cultivators of the soil to pursue

their inquiries in this important branch of research, the results of which, in various cases, appear to be so highly promising to their own interests, and to direct them how to conduct their future experiments under the most propitious circumstances that electrical science can suggest for increasing the productions of the land; and, under the impression that, although this is the first scientific essay on the theory and practice of Electro-Culture of Farm-Crops that has hitherto appeared, (and probably a mere precursor to others of a much higher value,) it will ultimately be found a step of some importance towards improving the condition of every race of the human family. Under these circumstances, a hope is entertained that the philosophical critic will weigh the author's motives in the same balance with his own remarks on the essay, and that the less initiated in science will be induced to suspend judgment until more facts have been collected than those derivable from the scanty experimental efforts of one solitary season.

1. *On the Disadvantages experienced in the Cultivating of Farm Crops from a Want of Scientific System.*

Considering the limits of scientific information, even in the highest grades of society, and the little attention that is devoted to scientific pursuits amongst those who are habitually associated with its cultivators, and daily deriving the most important advantages by various applications of the principles which those scientific labourers develope, it is not to be expected that persons who, from their rural location, are less favourably circumstanced for the acquisition of scientific knowledge, should display much skill in its application, or even become early acquainted with its advances.

The rules for cultivating the soil having, from the remotest ages of civilized life to nearly our own times, been transmitted from generation to generation by oral initiation only, the sources of information respecting past events in the growth of crops were merely those imperfect traditional legends which the memory of the senior husbandmen could supply. The farmer, thus deprived of a regular historical record of preceding results, or of the general experience of former ages, had no means of profiting by the labours of other cultivators of the soil beyond those of his own contemporaries, or, perhaps, of his immediate predecessors in the series of human generations within the narrow limits of his own locality. It is, therefore, a matter of no great astonishment that so little progress had been made in the management of farm lands previously to the recent introduction of foreign manures, and the subsequent employment of their

analogues, formerly wasted from a want of knowledge of their real value.

It was, however, about the commencement of the present century that a new era began to dawn in the cultivation of farm crops and in the progress of farm husbandry. Chemistry stept in and lent her aid in the choice of manures and in the general treatment of the land, and farmers have become alive to improvements from these means. They have also wisely associated themselves into bodies, with appointed assemblings, for the mutual exchange of ideas, and for stimulating each other, by conferring appropriate honours on those who, by superior management, produce the best specimens of farm culture, cattle, and crops. These agricultural meetings also afford ample opportunities for farmers making known the progress of their respective labours in the improvements in the land, for the guidance of each other, and for the benefit of the whole of their profession.

But notwithstanding this manifest alacrity amongst farmers of the present day in availing themselves of every improvement of their lands that scientific men have suggested, there is still wanting amongst them a *scientific ground-work* upon which they could operate with advantage on different soils, and calculate with certainty on the returns for their labours, under the usual circumstances of weather taken for a series of successive years. But this ground-work, as we have called it, can be formed of no other materials than those elementary principles which constitute science itself: of these it must essentially consist, which, being well understood, would enable farmers to proceed with their experimental inquiries on different kinds of land, in the most favourable direction and in the most judicious manner. Experiments thus conducted, together with the accurate observations necessarily attending them, and a careful record of the results in each case, would rapidly contribute materials for a grand superstructure of systematic farming, based on the imperishable principles of nature, and reared by the sagacity, diligence, and well-directed labours of the husbandman.

Farmers, however, as has already been intimated, have hitherto had no means of acquiring scientific knowledge; nor can they be supposed to take advantage of its *proper* applications, even from the investigations of scientific men, until the latter have become emancipated from the drudgery of earning their daily support in the ordinary employment of society,*

* The professors at universities, colleges, and other public institutions, derive the greatest portion of their support from their classes, the attendance on which occupies a great part of their time.

which prevents them from proceeding uninterruptedly in their investigations, impedes their progress at almost every step, and hinders them from the safe arrival at those immutable laws of nature upon which the whole fabric of agricultural science mainly depends.

The conflicting opinions of scientific men of the present day respecting vegetable physiology—the constituent elements of various kinds of grain and other crops—the appropriation of manures, their uses, or their totally useless influence in certain soils—the rotation of crops of the same kind, or of different kinds, &c., are ample illustrations of the present lamentable state of information on the vital elements of scientific farming.*

2. *Brief Outline of the Experimental Operations of Philosophers by the employment of the Electric Influence, artificially brought into play, in the culture of Plants, &c., and of their Opinions respecting the Influence of Atmospheric Electricity on Vegetation.*

The generally acknowledged influence of manures in promoting the growth of plants does not alone answer all the conditions of vegetable economy. Davy has said that "no manure can be taken up by the roots of plants unless water is present," a fact now pretty generally admitted by vegetable physiologists; and it is well known that vegetables, during the day time in particular, have the faculty of decomposing the carbonic acid gas of the atmosphere, the carbon of which they absorb, and elaborate in the formation of their organized matter. Hence the functional organs of plants, both above and beneath the surface of the land, are, during the progress of healthy vegetation, kept in operation on other compounds than those which *absolutely* constitute the manures.

But these well-established facts, notwithstanding the important information which they convey, and even involve the grandest question in vegetable economy, give no clue whatever towards its solution. By what powers, or by what physical forces, do the organs of plants display, and keep in operation, their respective functions of vegetable life, is a problem of vast importance in the basement ef agricultural science, and in every other branch of vegetable culture. This grand problem, the solution of which has not yet been accomplished, nor, indeed, scarcely attempted, presents the most formidable, and, at the same time, the most noble bulwark yet to be assailed in our inquiries respecting the functions of vitality in the vegetable kingdom.

* See the Report of the last Meeting of the British Association at Cambridge, (Athenæum for June and July 1845.) Also the premiums offered last year by the Highland and Agricultural Society of Scotland.

The most active physical agent known to philosophers is the electric; and the universality of its powers in the earth and atmosphere has led to the belief that these powers are extensively engaged in the promotion of vegetable life. Sir Humphry Davy, the most accomplished and successful electro-chemist the world ever saw, supposed it "probable that the various electrical phenomena occurring in our system must influence both the germination of seeds and the growth of plants," and says that he "found corn sprouted much more rapidly in water *positively* electrified than in water *negatively* electrified."*

Previous to Sir Humphry's day, many eminent electricians had entertained similar ideas respecting the influence of electricity in the growth of plants, and had carried on with success a great number of experimental inquiries in this interesting branch of research. Mr Maimbray, at Edinburgh, appears to have been the first philosopher who experimented on growing plants. This gentleman electrified two myrtle trees during the whole month of October 1746, when they put forth small branches and blossoms sooner than other shrubs of the same kind which had not been electrified."†

The Abbé Nollet "took two garden pots filled with the same earth and sowed with the same seeds. He kept them constantly in the same place, and took the same care of them, except that one of the two was electrified fifteen days together, for two or three, and sometimes four, hours a-day. The consequence was, that the electrified pot always shewed the sprouts of its seeds two or three days sooner than the other. It threw out a greater number of shoots, and those longer, in a given time, which made him believe that the electric virtue helped to open and display the germs, and thereby to facilitate the growth of plants."‡ Similar "experiments were carried on about the same time by M. Jallabert, M. Boze, and the Abbé Menon, Principal of the College at Angers, who all drew the same conclusions from them."§

It would be useless to swell this essay by a multiplicity of extracts from the various authors who have entered this field of research, since those already given are sufficient to convey an idea of nearly all the results that have been obtained by the employment of the electrical machine; for although a great number of trials have been made on different kinds of plants, and by philosophers well qualified for the task, and even artificial gardens have been electrified during the earliest periods of the inquiry, the results have almost uniformly been favourable to vegetation. Within the last few years several experiments of

* Lectures on Agricultural Chemistry. † Priestley's History of Electricity.
‡ Ibid. § Ibid.

this kind have been carried on by Mr Pine of Maidstone and Mr Weekes of Sandwich, both of whom obtained satisfactory results. But in this, as in all cases of novel inquiry, some electricians there have been who met with disappointment in their researches, and others have operated with such powerful electric discharges that they killed the delicate plants on which they experimented.

Since the appearance of the voltaic pile, in the year 1800, many trials of its powers have been made on the germination of seeds and the growth of plants. The results of these experiments, like those made by the electric machine, have been various, as might be expected from the different modes by which the experiments were conducted. Several experiments of this class have been made at different times by Mr Weekes, but none of them of a more interesting character than one which that gentleman carried on for several months during the past year.

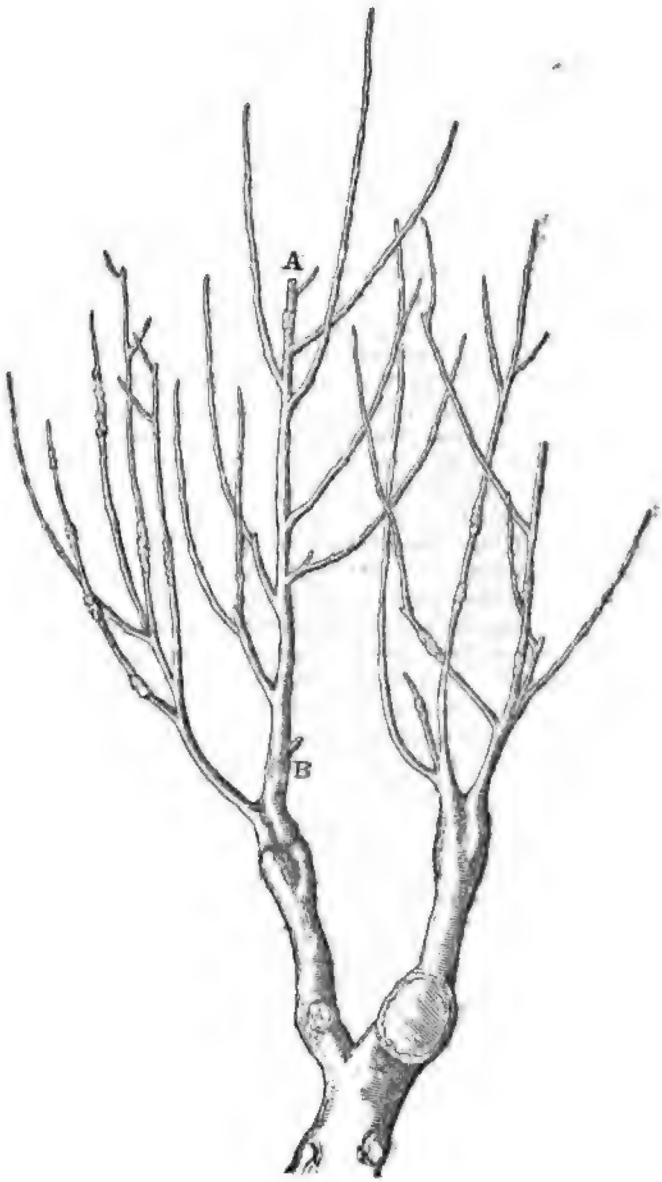
The battery employed in this experiment consisted of a single pair of metallic cylinders, zinc and iron; the former placed within the latter, and both in a glazed earthen-ware jar. The vacancy between the two metals, and between the outer one and the jar, was filled with finely-sifted earth, which was kept wet by a solution of common salt.

The subject of experiment was a single shoot of a dwarf apple tree of two branches, both of which were grafted with Deventon pippins, the grafts having been twice headed down. During the previous season it produced twelve tolerably strong and equal shoots, one of which, by no means the finest, was selected for the experiment. The apparatus was applied April 28th in the following manner:—A copper wire proceeding from the zinc cylinder "was plunged about half an inch into a spur projecting from the lower part of the shoot, a small portion having been cut off transversely to facilitate the operation." Another wire from the iron cylinder entered the pith at the top of the shoot, a small portion being cut off for that purpose.

It somewhat unfortunately happened that no blossoms made their appearance, and nothing remarkable was evident until a short time after the developement of the foliage, which took place pretty uniformly over all the shoots. Soon, however, the leaves proceeding from the electrified shoot presented the most characteristic and decided superiority over the rest of the tree, being not only much larger, but of a deep green colour, and fine glossy appearance. About this time the disease called *canker* made its appearance *on all the shoots*, and it was deemed necessary by the proprietor that they should be again headed down, with the exception of the one through which the electric current is still (August) passing. Notwithstanding this prudential measure, the ravages of the disease have continued upon every shoot, save the one under electrical influence, and the bark upon *that* shoot has recently returned to a sleek and healthy condition; and while the foliage of the tree generally has become shrivelled, brown, and rusty, that growing on the electrified shoot, to speak correctly, maintains a most vigorous appearance.*

* Electrical Magazine, Sept. 1845.

FIG. 1.



Whilst writing this part of the essay, I wrote to my friend Mr Weekes, to inquire if his interesting experiment was still going on, and with what results. The answer I received is most satisfactory, and being accompanied with an elegant drawing of the apple tree, as it appeared in December, will be interesting to our readers. It was this.

The apple tree which was lately the subject of my experiment is situated at some distance from my residence, and I am just returned from procuring the accompanying drawing of the present state of the tree; and you may rely upon the exactitude of the representation, so far as the pencil can be made available to such purpose.

Subsequent to the date of my paper, dated August 2, already in your hands, the shoot A, B, Fig. 1, continued to thrive vigorously under the influence of the electric current, which was constantly maintained until the foliage had entirely fallen off, and the frosts of December begun to interrupt the action of the battery, when the apparatus was removed.

At the commencement of the experiment, the tree consisted of twelve annual shoots, of very equal appearance as regarded their strength and height from the trunk. You will perceive from my sketch, Fig. 1, the superiority of the branch lately under electrical action, and that it now presents eight *laterals*, all stronger and larger than any on the other parts of the tree; *the eleven shoots of which together present only seven laterals*, some of which are dead, and others looking very sickly, from the ravages of the canker, a disease from which the electrified shoot has so far recovered, that, with two or three slight exceptions, its bark throughout is sleek and healthy. This last fact is one which may probably be turned to future advantage."

Hearing that Mr Edward Solly, Professor to the Horticultural Society, London, had carried on a number of interesting electro-cultural experiments during the present year, I wrote to him to inquire of his success; but as that gentleman had been seriously indisposed for some considerable time, he had been unable to make out his report for the society, intimating, however, in the answer which he favoured me with, that his results generally had been of a "negative character."

With regard to atmospheric electricity, (says Father Beccaria, who was a diligent observant philosopher, and one of the most eminent electricians of his day,) it appears manifest that nature makes an extensive use of it for promoting vegetation.

1*st*, In the spring, when plants begin to grow, temporary electric clouds begin to appear, and pour down frequent electric rains. The electricity of the clouds and of rain increases afterwards in summer, and continues to do so till that part of the autumn in which the last fruits are gathered; so that it appears that the electricity which obtains in clouds and rain, when carried to a certain degree, serves to promote, with regard to vegetation, the effects of common heat.

2*d*, It even seems that electricity successively supplies common heat itself with that moisture by the help of which it actuates and animates vegetation, which, if heat acted alone, would inevitably be stopped. In fact, it is the electric fire that gathers the vapours together, forms clouds with them, and afterwards dissolves them into rain. It is the same fire, therefore, that supplies the earth with the nutritive moisture which is necessary to plants, and this moisture, by melting the terrestrial saline particles it meets with, by diffusing them, along with itself, into the inmost pores of plants, causes them to grow and vegetate with such admirable and incomprehensible regularity.

3*d*, The common saying of countrymen, *that no kind of watering gives the country so smiling a look as rain* may be explained on the same principle. The rainy clouds, by extending their own electric atmospheres to plants, dispose the pores of the latter to receive with greater facility the liquid which is soon to follow; and the sur-

rounding drops penetrate into them the better, as every one of them carries along with it a portion of the penetrating dilating element.

I know that the regular distribution of water which is made by rain also contributes to render it particularly useful. It even seems to me that to each season belong kinds of rain more or less lasting—more or less sudden—and falling in larger or lesser drops, according to the different kinds of vegetation which, in every season, are to be promoted. Now, do not all these differences chiefly proceed from the different degrees of the electricity which such rains distribute or rather accompany? I have the knowledge of many facts which are favourable to these views.

Besides, the mild electricity by excess, (positive electric action of low tension,) which, as I have observed for these many years past, constantly prevails when the weather is serene, certainly contributes to promote vegetation, in the same manner as experiments have shewn us that this is likewise the effect of artificial electricity *without sparks.** And is it not likely that the former kind of electricity promotes vegetation still better than the latter can do, since nature increases it and lessens it in such circumstances and at such times as particularly require it.†

The experience and opinions thus enumerated in the glowing language of the illustrious Italian electrician, afford an excellent type of the results of inquiries, and of the notions generally entertained by philosophers, about the middle of the last century, respecting the influence of atmospheric electricity on vegetation. The inference, indeed, can scarcely be avoided by those who attend to the corresponding electro-fluctions of the air, with every minute change of weather that influences vegetable life.

3. *On the Elementary Principles of Electricity necessary to be understood by the Electro-culturist.*

Although the elementary principles of electricity are more numerous and of greater diversity than those constituting any other branch of science, it will not be necessary in this essay to touch on any other than those essentially concerned in the promotion of vegetable life, which are but few in number and easily understood. Moreover, it being pretty generally understood that electrical phenomena emanate from the action of a peculiar kind of matter, called *electric fluid*, an elaborate discussion on its peculiar characteristics would not only be foreign to the purpose of this essay, but tedious to many of its readers. It may not be out of place, however, to remind those not accustomed to the study of electricity, that this active element of nature is so universally diffused throughout every part of terrestrial creation, that it becomes an occupant of every part of the earth's surface, and of the shell of air that surrounds it.

This general definition necessarily leads to the inference that all the various objects which clothe the surface of the earth, such as trees, shrubs, plants, flowers, and crops of every kind, partake

* Our author here means the application of electricity to growing plants, by throwing the electric brush on them, from a sharp pointed wire or piece of wood.

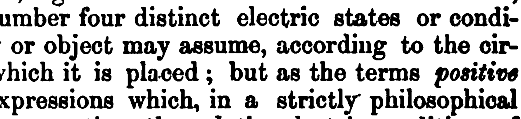
† Father Giambatista Beccaria, Professor of Natural Philosophy in the University of Turin, on Atmospheric Electricity.

of this electric distribution, and that each individual object is possessed of more or less of this extraordinary element, or, in electrical language, that each is possessed of its *natural share*. It must not be understood, however, that this natural distribution confers upon different objects an *equal* share, either in proportion to their magnitude, weight, or shape; but, on the contrary, that each object contains a share peculiar to itself, according to its degree of susceptibility of receiving the fluid, or, as some writers say, "according to its *capacity*." But, whatever may be the quantity due to any individual object, under ordinary circumstances, it becomes exquisitely susceptible of disturbance when the circumstances vary, and whether these be of natural or of artificial occurrence. A disturbance of the electric fluid in any body may be accomplished either by abstractions, additions, or by merely forcing a part of it to some particular side of the body operated on. In the first condition, the body would be *electro-negative*, in the second, *electro-positive*, and in the third, *electro-polar*. These, together with the *natural electric* condition, would appear to number four distinct electric states or conditions that any body or object may assume, according to the circumstances under which it is placed; but as the terms *positive* and *negative* are expressions which, in a strictly philosophical sense, imply nothing more than the *relative* electric conditions of bodies, any individual body or object may be *positive* to another, whilst, at the same time, it is *negative* to a third. Hence, the only *absolute* electric state that any body or object can appear in is the *polar*—a condition, as will be shewn in the sequel, growing plants must necessarily assume.*

The various objects which constitute the vegetable clothing of the land are never in precisely the same electric condition, being continually *positive* and *negative* with regard to each other. An

* Electro-polarization may be thus explained. When vicinal bodies are in their natural electrical conditions, they have no power to disturb each other's electrical equilibrium; but if the natural equilibrium of any of them becomes disturbed, the equilibrium of the others will become disturbed also. If, for instance, the body, A B, Fig. 2, and its neighbouring globe, were both in their natural electric conditions, they would have little or no influence on each other; but if the globular body were to become *electro-positive*, by any means whatever, it would immediately disturb the equilibrium of the other body, and in such a manner that the fluid belonging to the nearest end, A, would be driven towards the remote end, B. In this condition the body would be polar, having the end A *electro-negative*, and the end B *electro-positive*. If the globular body had become electro-negative, the polar condition of the other body would have been in the reverse order, having the end A electro-positive, and the end B electro-negative.

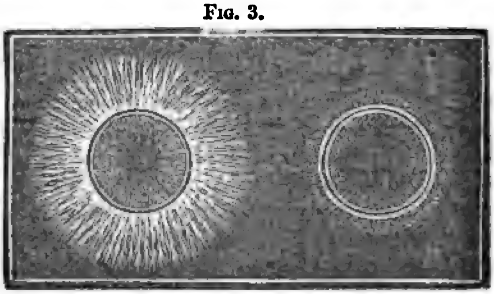
Fig. 2.



oak and an ash tree, for instance, though both in their ordinary or normal electric states, are not endowed with the same degree of electric force, one being *positive* to the other, and, consequently, the latter *negative* to the former. A similar inequality of electric force occurs amongst growing plants and their manures, and even amongst the various elements which constitute the latter, no two of them being precisely alike at the same time. The mineral productions of the earth also, as decidedly as those previously noticed, display a diversity of electric action amongst themselves, no two of them being found alike. Hence the particles constituting each and every variety of soil are endowed with a peculiar electric force—a circumstance of immense importance in the contemplations of the vegetable physiologist, and essentially connected with all electro-cultural operations.*

* The following highly interesting experiment is well calculated to illustrate the different electrical conditions of the particles of matter when in intimate contact with each other.

Fig. 3.



"Having procured a pitch cake, with a smooth surface, two circular patches of it are to be electrified, one positively, and the other negatively. The cake is now to be placed in a vertical position, and against its electrified surface an intimate mixture of sulphur and red lead is to be projected from a spring puff or bag, until the two electrized specks be partly covered, the *positive* speck with sulphur and the negative one with red lead; for the two powders will now be separated from each other by the electric forces of the cake. Hence we learn that, although these powders were intimately mixed in the bag, they were in different electric conditions.

"The figures which these powders assume on the surface of the pitch are truly beautiful, and to the theoretical electrician, are of the most interesting character. Fig. 3 will give some idea of these figures, but nothing short of real observation of the results of the experiment can convey to the mind their true beauty and importance. Even to a superficial observer, the ramifications of the sulphur on every side of the electrical nucleus are highly curious and pleasing, whilst the watchful philosopher observes the particles of sulphur repelled on every side, and creeping outwards in variously-formed radial lines, which expand the electro-stellate picture before his eyes. Inwards, also, the particles of sulphur keep advancing, until the electro-positive forces, on opposite sides of the centre, balance one another, and then the inward advances cease, and a vacant central speck remains.

"Turning the eye to the negative ring, it remains the same from first to last; no motions of particles are observed, nor has there been any of those radial shoots such as the sulphur displays. Such results not only demonstrate the different electric actions of different bodies, but stamp the mind with conviction that the whole series of electrical phenomena are the consequent display of the inherent attributes of a peculiarly-active physical agent, perfectly distinct from all other kinds of terrestrial matter."†

† Sturgeon's Lectures on Electricity, p. 238-40.

From the character of results in a variety of experiments familiar to electricians, we have a striking demonstration of the particles of electric fluid being repellant of each other—a property which finds its analogue in all ærial fluids. Hence it is said with propriety that the electric fluid is elastic, and that bodies similarly electric *repel* each other. From the results of another class of experiments, we infer that bodies in different electric conditions *attract* each other; and as no facts are known to contravene this inference, it has became an established principle in electric science. Upon these attractions and repulsions the doctrine of electro-chemistry is essentially based, and to these principles alone are chemical changes due. The elements of compounds have only to be assailed by electric forces more powerful than those which hold them together, and decomposition is a certain result; and bodies which will not associate with each other under ordinary electric circumstances, can easily be forced into combination by the aid of additional electric forces properly applied.

Contemplations on electro-chemical forces thus disencumbered of complexity, lead, by easy gradations, to many recondite operations of nature, and to the discovery of those hidden actions by which the ever-varying transformations of matter are accomplished. They are well calculated to afford a clue to those atomic operations which, in silent seclusion, select the appropriate materials, convey them to their destination, and elaborate them in the structure of every vegetable tissue that is formed within and upon the surface of the land.

When the electric fluid is in abundance and in motion it is accompanied by a developement of heat which in some cases is of sufficient intensity to fuse the most refractory substances. Electricity, like heat, has its *conductors* and *non-conductors*; but in some cases they are different for the two kinds of force. For instance, charcoal is a good conductor of electricity, but a bad conductor of heat. The metals are the best electrical conductors, but there are many other kinds of matter which rank high in this capacity. Such, for instance, are trees when full of sap, water, and consequently all growing plants, by virtue of the water they contain. Moist land is also a conductor of electricity. Dry sand is a bad conductor, so is dry mould of every kind; but limestone rock and dry chalk are still worse, and dry air is a worse conductor than any of the rest; though moist air is a tolerably good conductor. When the electric fluid meets with a good conductor, it spreads with rapidity over the conducting surface; but when it meets with an inferior conductor it has to encounter a resistance which, in some cases, it is unable to overcome; consequently its forces are limited within a certain range of locality.

The stellar picture formed by the sulphur in Fig. 3 affords a striking illustration of the limited range of the electric forces on the surface of an inferior conductor; whilst, at the same time, it shews the expanding tendency of the electric fluid in every direction. See also Fig. 4.

Another grand law of electricity to be noticed by the electro-cultural physiologist is the following:—In all cases of electrical disturbance, whether the fluid be in the act of absolute transfer from one body or object to another, or traversing conducting channels in the character of currents, or that it be spreading itself over surfaces of moist land or other conducting matter, the transmission is uniformly *from the positive to the negative parts;* for in no case can the fluid be transmitted *from* a negative *to* a positive body, nor from a *negative part* to a *positive part* of one and the same body. Hence it is that those parts of the prime conductor of an electrical machine which are in the act of *receiving* fluid from the revolving glass are *negative* with respect to the latter, although, at the same time, the remote parts of the conductor be positive to all surrounding bodies, and whether they be delivering the fluid as fast as they receive it or not. Therefore the prime conductor is electro-polar under all circumstances, when the machine is at work. Now, as this is a universal law when electric fluid is transmitted from one body or object to another, it follows that the electro-positive state of the air contiguous to growing plants causes the latter to become *electro-polar*, even when they are in the act of transmitting fluid to the ground, their upper parts being negative relatively to the roots, whilst the latter, in their turn, are positive to the contiguous manure and soil, to which they deliver up the fluid (or rather such portions of it as are not retained for the expansion and growth of the plants) as faithfully as the leaves and stems receive it from the air.

From this train of reasoning we are led to some of the most interesting points in vegetable physiology. The electro-polar condition of plants qualifies them in an eminent degree for the performance of those operations which develope electro-chemical phenomena; and, what is very remarkable, the laws of this beautiful branch of electricity are rigidly enforced and admirably complied with in the decomposition of carbonic acid gas by their foliaceous parts; for, in this process, the *electro-positive* carbon is drawn to the electro-negative poles of the plants, in precisely the same manner as any electro-negative pole, artificially made, would release the carbon from the oxygen, and select it in preference.

This remarkable fact, firmly based as it is on the strict principles of electrical action, not only establishes a correct view of

the *modus operandi* by which plants are enabled to acquire food through the instrumentality of their foliage, but appears to me well calculated to give a clue to every operation by which vegetables become nourished and elaborate their food, in all the variety of structure they so abundantly and beautifully assume. But as the electro-physiology of the vegetable kingdom has never yet been explored beyond the humble examination of one operation only, any further remarks on a subject so imperfectly understood would be premature in this place; although no doubt can now remain respecting the influence of electric forces in rearing, adorning, and giving full developement to every class of vegetable structure.

4. *Atmospheric Electricity.*

There is no part of electricity more essential to be understood by the farmer than the electrical relations naturally subsisting in the earth and contiguous air, and of the various means which are available for supplying the former from the latter, with additional electrical forces during certain seasons and peculiarities of weather when nature withholds the necessary supply; for it is these relations, and means of modifying them, that are mostly concerned in the *electro-culture of farm-crops.* Electrical machines and voltaic batteries may still continue their usefulness in operations on individual plants within the limited range of a few flower-pots, or even on small plots of land in a garden; but it is the electrical operations on the grand scale of nature alone that must be had recourse to by the farmer, whose extensive lands and crops, over which he experiences so much care and solicitude, are the objects of *electro-cultivation.*

That the atmosphere at all altitudes hitherto explored is, during a cloudless sky, in an electro-positive condition with respect to the ground beneath it, is a fact well known to electricians. These normal relations, however, are liable to great and frequent fluctuations, arising from the vicissitudes of weather. Winds, frosts, hail, rain, snow, fogs, &c., and all those changes of weather which influence the growth of plants, are accompanied with corresponding variations in the electric state of the air; but in no case is the normal state so much disturbed as during the presence of highly-charged thunder-clouds. In those cases the disturbance is so great as to completely reverse the normal relations of the air and contiguous ground, the former becoming *negative* with regard to the latter. These reversals of the ordinary electro relations of the air and contiguous land, although as transient as the passing cloud, will have a considerable influence on vegetation, by pressing into the soil immense floods of electric fluid from the vicinal air; for as the sharp edges and

points of the leaves of trees, grasses, corn, and growing plants of all kinds, are exquisitely adapted to facilitate the ingress and egress of those electrical floods, each individual leaf, stem, branch, &c., that constitute the vegetable clothing of ground, becomes one of the multitude of channels through which the transient electro-tidal fluxes and refluxes are conducted; and thus the grand wave which sweeps the land becomes divided and subdivided into myriads of minute stimulating electric streams.

As the implements of research employed by philosophers of different countries, in their electro-explorations of the atmosphere, are available in the electro-culture of farm crops, an outline of these ærial operations will be interesting to the reader. M. Monnier, who made his experiments at St Germain en Laye, in the year 1752, appears to have been the first who suspected, and proved, that the air of the atmosphere contains a quantity of electric fluid during the entire absence of clouds.* "But more accurate experiments were made upon the electricity of the air by the Abbé Mazeas, at Chateau de Maintenon, during the months of June, July, and October 1753."† The Abbé's apparatus consisted of a stout iron wire 370 feet long. It was raised 90 feet above the ground, by stretching it between the top of the castle and a steeple in the town. It was insulated by silken cords at both ends. In the month of June, the wire was found to be electrical in the highest degree from sunrise till about seven or eight o'clock in the evening, and most of all in dry weather. In moist weather no signs of electric action could be perceived. "The strongest common electricity of the atmosphere (the normal state, during a cloudless sky) during that summer, was perceived in the month of July, on a very dry day, the heavens being very clear, and the sun extremely hot."‡ On the 27th of June, during the presence of stormy clouds, the Abbé drew sparks from the wire, "though there was neither thunder nor lightning."§ Mr Kinnersley, who was an excellent electrician, and contemporary of the Abbé Mazeas, observed, from his own experiments, "that when the air was in the driest state there was always a considerable quantity of electricity in it." When this philosopher made his kite experiments "in dry weather, and so clear that a cloud could not be seen," he found the air positive with respect to the ground.‖

The most extensive series of experiments ever attempted on atmospheric electricity were those of Father Beccaria, the Italian philosopher, whose opinions on the influence of electricity on growing plants have been extensively quoted in previous pas-

* Priestley's History of Electricity. † Ibid. ‡ Ibid.

§ Ibid. This is an instance of electrical disturbance by the influence of clouds.

‖ Ibid.

stages of this essay. Beccaria was Professor of Natural Philosophy in the University of Turin, and his experiments were carried on at all seasons of the year, from 1756 till 1775, in various parts of the surrounding mountainous districts. Many of the Professor's experiments were made by means of electric kites; but the greater portion of them by means of wires stretched between the tops of lofty objects.

"On the latter end of March," (1756,) says father Beccaria, "I climbed the high and steep mountain of St Michael, and there I stretched and insulated several iron wires; the one in the direction of the meridian of the monastery, to the ruins of the *sepulchre*, which was 1600 feet long. Another 120 feet long, from the same place, and in the same direction, to a battlement of the monastery; another 112 feet long, at the same height, and eastward, to a storehouse; another 160 feet long, from the steeple to the ruins of the portico, westward; and, lastly, I fixed a pole on the top of the church, on which I had insulated a metallic point, by means of a glass stick, and another iron wire, 40 feet long, extended from this point to the neighbouring steeple."* On the 11th of May 1757, this indefatigable observer stretched a "long rope" (of metallic wires) across the "river Po, from the villa of *the Mission* to the Valentin; and from this rope an iron wire was continued to the portico of the Botanic Garden," from which electric sparks were frequently drawn the following day, and at other times subsequently. Besides these preparations our philosopher erected many other similar apparatus in different parts of Piedmont and its Alpine and Appenine boundaries. One of these, from which many interesting results were obtained, was placed "on the pleasant hill of *Garzogna*, which is situated in the neighbourhood of Mondovi, and from which the whole compass of the Alps, as well as the whole plain of Piedmont, is easily seen. This vast extent, both of country and sky, that opens before the hill," says our author, "I take particular notice of, as contributing much to the success and certainty of the experiments."† The inference drawn from all the extensive and well-directed series of experiments made by this philosopher is thus emphatically stated in his own words. "Ever since I began to observe the atmospheric electricity during *serene* weather, the whole series of my observations has confirmed it to me, that this electricity is constantly of the *excessive* or positive kind."

The electro-atmospheric explorations that were made by the early electricians of this country, were, in many instances, by means of long rods like fishing-rods, having wires attached to

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* Beccaria on Atmospheric Electricity. † Ibid.

their upper ends, and elevated in the air either from an upper window or by being attached to the outside of a chimney. By such pieces of apparatus experiments were made by Tiberius Cavallo, John Read of Knightsbridge, and the Rev. Abraham Bennet, curate of Wirksworth, Derbyshire, all of whom agree in the fact that the normal or usual electric state of the air is *positive* to that of the ground.

During a course of moderate weather, (says Mr Read, at the close of his journal of two years' observations,) the electricity of the atmosphere is invariably *positive*, and exhibits a flux and reflux, which generally causes it to increase and decrease twice in twenty-four hours. The moments of its greatest force are about two or three hours after the rising, and some time before and after the setting, of the sun; those when it is weakest, are from about mid-day to about four o'clock. The periodical electricity of the atmosphere seems to be manifestly influenced by *heat* and *cold*. Hence it plainly appears why we always find warm small rain to be but weakly electrified; whilst cold rain, which falls in larger drops, is the most intensely electrified of any.

Mr Crosse of Broomfield, near Taunton, Somersetshire, has had for many years past a series of metallic wires stretched at a considerable height above the ground in his extensive domain, from which he has obtained very interesting results, confirming those of Beccaria and other observers respecting the normal relations of the air and contiguous ground. "In the usual state of the atmosphere, its electricity is invariably positive."* Mr Ronalds of Hammersmith met with similar results.

Notwithstanding the interesting character of the experiments already noticed, they were not calculated to convey any idea respecting the electrical constitution of the atmosphere itself, or whether it was uniformly charged throughout, or differently charged at different altitudes. This, although an important question to the atmospheric electrician, remained almost untouched until the memorable balloon excursion of MM. Biot and Gay Lussac in the year 1804. These philosophers, when at the height of about four miles, let down, from the edge of the car, a long metallic wire, weighted at the lower end, and insulated at the upper one. By these means, and the help of an electrometer, the stratum of air which the lower end of the wire penetrated, was found to be *positive* with respect to that in which the balloon was floating. From this fact it was concluded that the upper regions of the air are more highly charged with the electric fluid than the lower ones.

The extensive series of electrical kite experiments that I have myself made for many successive years, and in different seasons, have enabled me to become pretty well acquainted with atmospheric electricity; and, with respect to the electrical relations

* Singer's Electricity, in the Description of Mr Crosse's Experiments.

of the earth and a cloudless atmosphere, the results have uniformly been in strict accordance with those obtained by other experimenters; for I never yet met with an instance, under these circumstances, in which the ground was positive to the air above it. In March, when the wind is easterly, the air dry and frosty, and the whole visible sky perfectly clear and cloudless, I have generally obtained high electric charges from the kite-string. On one occasion, at the Military Academy at Addiscombe, spontaneous discharges of a two-gallon Leyden jar, to which the kite-string was connected, took place more rapidly than can be accomplished by a powerful electric machine. On this occasion the wind was brisk, the air frosty, and no cloud was seen for several days before and after this occurrence. The kite floated high with about 700 yards of string.

By employing four or five kites at the same time, and floating them at different altitudes, ranging from 100 yards to half-a-mile high, I have always found that the uppermost kite was *positive* to all the rest, and that the lowermost one was *negative* to all the rest, though still *positive* with respect to the ground on which I was standing. The intermediate kites were *positive* to all those beneath them, but *negative* to all those at a higher altitude. Hence, since the lower extremity of the metallic strand, in the string, will always indicate the electric state of that stratum of the air in which the upper extremity is situated, the only inference that can be drawn from these experiments is, that there is a gradually increasing electric charge in the atmosphere from the lowest stratum to the highest altitude hitherto explored; and, by analogy, there is a high degree of probability that this increase goes on to the highest stratum of the air. Moreover, as the air is a better conductor in proportion to its attenuation,* there are strong reasons to suppose that at altitudes increasing arithmetically the electric charge increases geometrically, which is the ratio of attenuation of the air.

With respect to *electric waves*, already alluded to as having their peculiar influence on vegetation, they never occur during a cloudless sky. They are produced by clouds highly charged with electric fluid, by disturbing the normal equilibrium of that of the surrounding air, and driving it from the lowest stratum into the land, through the medium of its vegetable clothing and the moisture that lodges in the mould. Clouds highly charged being endowed with a formidable repulsive force, act at a great distance, and at all times of the year. In the spring and summer months, they are often productive of lightning, and teem out

* A more philosophical view would be, that it offers a less resistance in proportion to its attenuation, from which might be inferred, that *space*, exterior to the air, is still higher charged than the highest stratum of the atmosphere.

heavy rains, which bring down immense quantities of electric fluid to the ground, and occasion those smiling looks and healthy changes in vegetation which no ordinary showers ever produce. In the winter, also, and early in the spring, highly-charged clouds sometimes make their appearance, and are attended by high winds, drifting snow, and hail. They are frequently well defined, and perfectly insulated from all other appearance of cloud, and float with great velocity over an extensive tract of country, each producing its respective *electric wave* over the land to a great distance on every side. Lightnings sometimes proceed from these clouds, but not so frequently as from those which transit the country in the summer season.

At all times when lightning clouds are present, the greatest caution is requisite whilst carrying on experiments with the kite. I have experienced many severe blows from the string, when the disturbing cloud was at a great distance, and have seen streams of the fluid pour furiously over two yards of the insulating cord. On one occasion, a globe of fire, about the size of a musket ball, ran down the string to the ground. The points and edges of the grass for some yards around the young tree to which the kite string was fastened, were beautifully illuminated, and a peculiar rattling or loud hissing noise proceeded from the upper parts of the string. Lightnings were playing almost incessantly over head and on every side, though none struck the kite nor its string. Hence the fluid which traversed the latter was a portion of that which the lightning disturbed in the neighbouring air. In consequence of the heavy rains and low wind, the kite could not be raised more than a few yards from the ground, not more than fifty yards of string being out at the time.

Similar phenomena, but on a more magnificent scale, were observed by M. de Rornas, on the 7th of June 1753, whilst his kite was floating 550 feet from the ground, and no lightning cloud near.

Electrical waves have been manifested in a most remarkable manner by the extensive apparatus of Mr Weekes of Sandwich, who had 365 yards of wire stretched over a part of the town, between two church steeples, with a branch-wire descending into his laboratory. The first grand display of electric phenomena from this apparatus occurred on the 16th of September 1840, and are thus described in this philosopher's own words :—

A few minutes before noon, a stupendous, dense, and heavy-looking black cloud, having its edges remarkably depending and flocculent, advanced immediately over the line of wire, and commenced discharging its aqueous contents most furiously. This had no sooner obtained than a continuous torrent of sparks of the *first magnitude* passed violently from the large globular terminus of the atmospheric machine to the inferior receiving ball, attended by corresponding sharp cracking explosions, each being equal to the report of a moderate-sized pistol, and resembling in general effect the well-known running-fire occasioned by the rapid discharge of a multiplicity

of small fire-arms. With short intervals of a few minutes, as clouds of a similar character continued to arrive over the line of wire, these splendid phenomena recurred with more or less brilliancy until about three o'clock P.M. At one period during this grand display, three distinct flashes of lightning were observed in brief succession, and, almost identically with the appearance of each flash, streams of brilliant fire, having most extraordinary intensity, rushed through the apparatus with a loud hissing sound, similar in its effects upon the auditory nerves to that which obtains when a considerable mass of red-hot iron is suddenly thrown into water. However, in one instance, the cloud from which the electrical discharge proceeded, could not have been very near the line of our operative arrangements, as from five to six seconds were distinctly counted between each flash and the thunder which followed.*

On the 9th of May, the following year, our philosopher had another opportunity of witnessing a series of brilliant effects from his atmospheric apparatus. On this occasion a hail-storm, with flashes of lightning, was raging on every side. Torrents of sparks, three and a-half inches long, rushed through the apparatus, "and so vivid as to dazzle the eyes of the observer, attended by contemporaneous stunning reports." Flashes of the electric fluid were seen darting amongst the various pieces of apparatus, in almost every part of the laboratory; but the most remarkable phenomenon of that day's grand spectacle was the fusion and brilliant scintillation of an iron nail which connected the machinery of a pump. This nail "suddenly exhibited the appearance of a magnificent fire-work, the splendour of which was repeatedly enhanced as *waves* of electric fluid rushed through the arrangement, in obedience to each successive lightning-flash from the storm-cloud." This sublime scene lasted about an hour and a-quarter.†

I have been particularly solicitous in bringing these facts to the notice of the electro-cultural farmers, in order to convince them that the apparatus about to be described under the next head is admirably adapted for conveying to the land immense quantities of electric-fluid when disturbed, in the vicinal air, by lightning, or even by the presence of highly-charged clouds; and that, at other times, when no cloud is present, the apparatus is capable of supplying the soil with a greater quantity than it could otherwise receive from the contiguous dry air.

5. *On the Practice of Electro-culture of Farm-Crops.*

From the elementary principles of electricity, and the several circumstances attending their operations, as laid down in the previous parts of this essay, the electro-culturist will be somewhat prepared for commencing his future investigations with that degree of confidence which scientific circumspection will allow of, and of forming a tolerable idea of the circumstances most likely to interfere with the results of his experiments; but, as

* Annals of Electricity, &c., vol. vi. † Ibid.

many of these cannot be foreseen, and must necessarily occur at different times subsequent to the erection of the apparatus, they could not be provided for, if even it were necessary. Fortunately, however, the apparatus is not liable to injury, excepting from violent winds or from flashes of lightning—the former by breaking the poles, and the latter by fusing the wires, which can happen but very seldom.

The first instance of which I can find any account of vegetation actually being observed to be promoted by electricity, when brought down by a metallic conductor, was in the garden of a Venetian senator, on the river Brenta, in North Italy. It is said that vegetables growing near this conductor were much finer than any other of the same kind in the garden. This, however, seems to have been an accidental circumstance, as the iron rod was not intended for any such purpose, being erected for a lightning-conductor to protect an adjoining building. Mr Morgan, in whose lectures this circumstance is related, comments upon it with his usual severity, and very unnecessarily ridicules it as an absurdity of a very glaring nature. "If," says this author, "the electric fluid passed *into the ground through the conductor*, how could it influence the vegetables? If it passed *out of the ground through the conductor* the same question may be asked, and the same impossibility will be apparent, of the vegetables being influenced by a power which is carried off by a different channel."

Had Mr Morgan been alone in entertaining this opinion, its remote date (1794) might have been an excuse at the present day, for allowing it to pass unnoticed. But as we have yet eminent electricians amongst us whose views are nearly, if not exactly, in accordance with those taken by our author, it may be well to draw their attention to the influence of *rain* on vegetables, which *does not* pass into the ground through their leaves and branches, before they denounce, with too much rigour, the influence of the electric fluid which a conductor carries to the ground. There is every probability before us, and not even a suspicion left to the contrary, that the grand stimulus of vegetable life is the electric fluid, under which impression we are forced to acknowledge that agent to be as essential to the welfare of plants as either rain or manures; for, independently of a stimulating force, neither manure, rain, nor soil, could lend even the remotest aid in propagating vegetable structures.

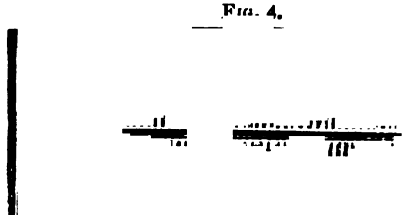
The experiments of Mr Forster of Findrassie House, near Elgin, which were carried on last year, have commenced a new era in electro-cultural inquiries; and their flattering results have induced several persons, electricians and others, to try the same plan on crops of various kinds of the last year's growth.

The plan pursued by this gentleman is that of stretc long iron wire between the tops of two long poles placed cally in the ground, and continuing both ends of the wire wards, so as to connect them with another wire, whicl buried about three inches deep round the plot of land int to be electrified. By this arrangement, the suspended wi that buried round the plot formed one connected systen any electric fluid collected from the air by the upper part system would be immediately conducted to the land and buted on all sides of the under-ground wires, according t principles already illustrated under Section 3.*

The experiments were made upon three distinct plots ol sown with chevalier barley, which, for distinction, are called and C, and all of them parallelograms, the breadth of each about half of its length, and so situated that the longer should be in the direction of the compass-needle (magnetic dian) at that place. About the middle of the ends of each pl poles were erected, one near to each end, as represented in I in which NS is the length of the plot, N being the north end, and the two black dots the places of the poles. The wire stretched between the poles is in the direction of the dotted line, which is supposed to be in the magnetic meridian, a position which Dr Forster chose for the suspended wire, from some information he had obtained, that a constant electric current "is found to proceed from east to west (through the air) over the whole of the earth's surface;" and, consequently, a wire stretched at right angles to it was the most likely position for receiving fluid from the air. poles erected in the two smaller plots, A and B, were fou high, and those on the larger plot, C, were eleven feet high

FIG. 5.

FIG. 4.



* The distribution of electric fluid, when emanating from a straight metallic wire, will be amply illustrated by Fig. 4. The wire is laid on a resinous cake, or any inferior conducting substance, and electric fluid communicated to it, which spreads on every side on th... electrified is brought into view by projecting flour of brimstone upon it. C ter conducting surface the distribution is more extensive, but still in a manner.

ground. The following is the report of the results of these experiments as given by the Doctor himself:—

All the results, as yet, (October 1, 1844,) are imperfectly known, but these were, or are, evident.

1st, The barley plants on the two smaller plots, (of 8 poles each,) A and B, soon became darker in colour and grew faster, until they had attained to about a foot in height; the darker green colour then gradually disappeared, and at the end of a fortnight after there was no perceptible difference but in the height of the young barley plants, and even this ceased to be very apparent as the crop advanced.

2d, When the barley of the larger, or 24-pole plot, C, was 6 inches high, it assumed the same lively dark green colour, and grew faster than the surrounding unelectrified barley plant; and this difference it maintained up to the last, except the colour, of course, in time became yellow, and it was curious that this change occurred later than in the rest of the crop. The number of stooks was also greater, and each larger when reaped—the ears from one grain of seed more numerous and longer. The corn also is larger and harder.

This is all that can be said at present (October 1) of the larger plot, C; for although the crop is stacked separately from the rest, still, until thrashed, weighed, and measured, no more perfect idea of the facts can be conveyed to those who have not seen the difference of the crop thus electrified.

The report of the electrified crop, after thrashing, is dated November 29, 1844. "The day before yesterday, I thrashed, weighed, and measured, the electro-cultured chevalier barley. The space it occupied was 23 English poles, (more than one pole of the 24-pole electrified spot having been occupied by Victoria barley.) The product was, from the 23 poles, 15 bushels of barley, the bushel weighing 54½ lb., (23 lb. beyond the usual average,) thus giving 13 quarters, or 104 bushels per acre.

"The weight of the straw from the 23 poles was 1,350 lb., equal to 3,939 lb. per acre. I do not know the usual average of barley straw per acre, but it is easily ascertained and compared with this. The tail corn was not weighed. I believe the straw will be found, as the product of the barley is, double the average weight and measure obtained from the acre."

The following is a note attached to the Report. "It appears from Stephen's *Book of the Farm*, page 1070, that of a very large crop of barley of 60 bushels, the straw weighed 3,080 lb. per acre, so that, instead of double, the straw (obtained from the experimental plot) was more than triple the average."

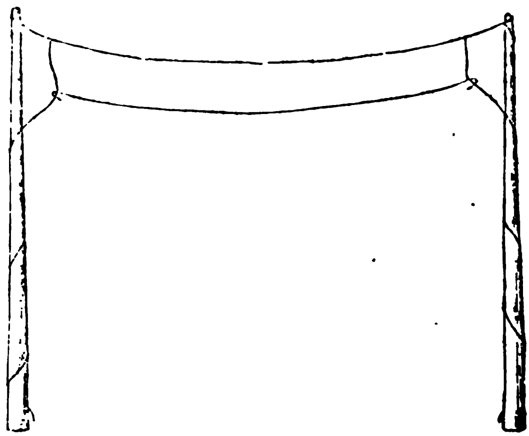
There was another circumstance attending one of the Doctor's experiments which, from its interesting character, is particularly worthy of notice. On the plot B, of 8 poles, the suspended wire of 4 feet high was found to be too low; he, therefore, fixed to each pole a piece of "dry pine 8 feet high, and suspended two wires to them, one at that elevation, and another a foot lower down, and was pleased to find that, after some time, this plot *partially resumed its former dark green colour*" which it had previously lost.

The lucid and highly interesting report thus given by Dr Forster, of his first series of experiments, which promised to lead to incalculable benefits to all civilized nations, was an inducement of no common order to enter into the inquiry with as little delay as possible; but being from home at the time the report arrived at my house, and not returning for some weeks afterwards, I was almost too late in getting the information to repeat the experiments to advantage on crops of the last year's growth.

Willing, however, to let no opportunity escape without making a trial, so far as circumstances would permit, I applied to my friend, Mr John Moore, who, being one of the council of the Manchester Botanic Garden Society, soon obtained permission for the erection of an apparatus in their grounds, and which, with the assistance of Mr Campbell, the curator, was accomplished on Wednesday, April the 23d, on a plot of grass in the back lawn.

The figure of the plot enclosed by the under-ground wires was similar to Fig. 5, a parallelogram 20 yards long by 5 yards wide. A pole 15½ feet high was firmly fixed in the ground at each end of the plot, as at N and S, Fig. 5, and north and south of each other per compass-needle. The wire employed was of iron; two lengths of which were suspended in the air, between the tops of the poles, as represented by Fig. 6, one of the strands

FIG. 6.



being about 18 inches below the other. A branch-wire, descending from each end of this aerial pair, was twisted a few times round its respective pole, for security, and its lower extremity connected with the under-ground wire, so that by these means the several parts of the wire formed one connected system.

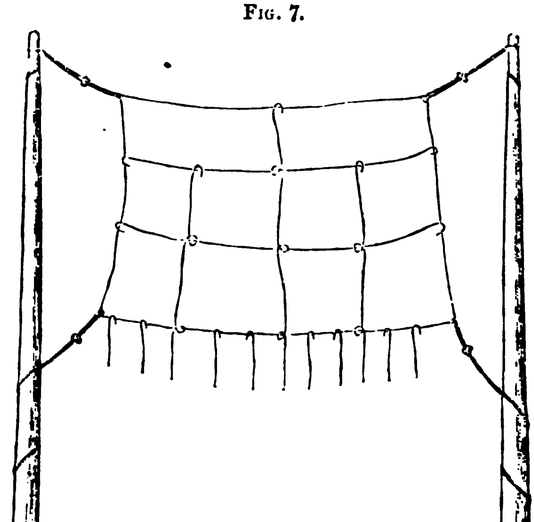
On the 24th of April I erected an apparatus, similar to that already described, on a field of oats farmed by Mr Jackson, in Sir Thomas Traffrod's park, about three miles west from Manchester. The under-ground wire enclosed a parallelogram 30 yards long and 10 yards broad. The ends of the plots stretched across two neighbouring ridges, and the poles, which were the same length as those in the botanical gardens, wereplacedinthefurrow between them. This furrow, which was the axis of the parallelogram,

happened to be very nearly in the magnetic meridian. The corn plants were about two inches high when the apparatus was erected.

On Friday, April the 25th, I visited Michael Holt's farm at Didsbury, about six miles south east of Manchester, and got permission to erect an apparatus in a field where wheat, oats, and barley were growing, and on Monday the 28th the apparatus was erected. The poles, one of which was 17½ feet, and the other 13½ feet* above ground, were erected in a furrow between a ridge of oats and a contiguous ridge of barley. These furrows also happen to be nearly in the magnetic meridian. The poles were 30 yards assunder, which was the length of the parallelogram of land enclosed by the under-ground wires. The breadth of the plot was about 12 yards, and extended across the two ridges—the oats on the western ridge and the barley on the eastern one. The plants were about two inches high.

On Wednesday, April 30th, I erected a second system of wires in Sir Thomas Trafford's park, on the same crop of oats as the other apparatus was placed the previous week. The poles were 16½ feet above ground, and 30 yards apart; but the system of wires in this case was very different to any of those previously described. It consisted of four parallel wires, which hung in the same vertical plane between the poles, and were connected together by cross vertical wires, in the manner shewn in Fig. 7.

Fig. 7.



From the lowermost wire hung a number of short thin pieces

* These lengths of the poles were not chosen intentionally; but were employed because no other poles were on the farm.

of wire, for the purpose of throwing on to the crop any electric fluid that might be caught from the air by the reticulated system to which they were attached. The whole of this metallic system was well insulated by means of four silken cords and tarred ropes, which kept it stretched between the poles without touching them. Half of each insulating cord was of silk, and the other half tarred rope, the latter being tied to the poles. When thus stretched by the ropes at the four corners, this system had the appearance of an *electrical net*, which, by exposing an extensive metallic surface to the air, had a good chance of collecting more fluid than a single wire could do.

On Saturday, May 17th, I erected an apparatus at Kirby Lonsdale, Westmoreland, on a field of grass belonging to the vicar, the Rev. J. Hutton Fisher. The field is situated on a limestone rock, at a considerable elevation above the bed of the river Lune, which flows through the valley at the distance of about a quarter of a mile. The limestone substratum is covered with good brown mould, which has produced crops of grass for many years. The field had been well manured with guano about ten days previous to our electrical arrangements, and the grass was then in a healthy condition. The apparatus was similar to that at Didsbury, only on a larger scale. Mr Fisher being desirous of having the experiment made under precisely the same circumstances as that at Findrassie, lent me an excellent pocket compass, by means of which the magnetic meridian was very easily ascertained, and in this meridian the suspended wires were hung with a tolerable degree of accuracy. The poles, when erected, were 16½ feet high above ground, and 55 yards apart, which was the length of the parallelogram enclosed by the under-ground wire. The breadth of the plot was 22 yards. The sods, which were removed to make the gutter for the reception of the under-ground wire, were carefully replaced, after securing the latter at the angles of the plot by means of hooked wooden pegs.

On Saturday, May the 24th, I erected my sixth apparatus on a field of grass in the rear of Casterton Hall, the elegant and beautifully situated mansion of Mr W. W. Carus Wilson. The dimensions of the apparatus were precisely the same as those at Kirby Lonsdale, and the position, with regard to the magnetic meridian, the same also. The land had been manured some weeks previously with the excrementitions, liquids, and water, collected from the stables and cow-houses. The grass was healthy, and about six or eight inches high. The servant men who assisted were very careful in cutting the gutter for the under-ground wires, and also in replacing the sods.

In all these six cases, the wire was of iron, and the suspended parts hung in the magnetic meridian, or nearly so, of the re-

spective places. The under-ground portions were secured by means of hooked pegs at the angles of the plots, three inches below the surface of the land, and covered in by the mould in the corn-fields, and by the sods in the grass-fields, that had been removed to make the gutters for their reception. These precautions were taken in order that five of the experiments might be conducted under precisely the same arrangements of apparatus as those at Findrassie.

The insulated system of wires represented by Fig. 7 was employed for the purpose of transmitting immediately to the leaves of the corn plants any electric fluid the system might collect from the air, in order that the plants themselves might become the medium of conduction to the roots and contiguous soil; for as this seems to be the route employed by nature in her electro-transmissions from the air to the ground, under almost every circumstance of weather, when rain is not falling, there is reason to believe that the fluid is beneficially employed by the plants during its downward transit through them.

6. *Results of the foregoing Experiments.*

In the Manchester Botanic Gardens.—In consequence of my absence from home, I had no opportunity of visiting any of the grounds on which the apparatus was erected in the vicinity of Manchester, till Thursday, June 19th. On that day I visited the Botanic Gardens, when, to my surprise, instead of finding the grass all around the plot enclosed by the under-ground wires standing and unmolested, I beheld the site only closely shaven by the last *weekly operation* of the sythe, to which it had been subjected from the time the apparatus had been erected, so that no means were left for comparing the grass *within* the wire and that which ought to have been standing outside. Indeed, so strictly had the scythe's-man adhered to the rules of practical geometry, that the boundries of the parallelogram were as accurately defined as if drawn on paper by a nicely pointed pencil.

On the 24th of June, Mr Campbell, the curator, removed the apparatus to another plot of grass which was permitted to stand unmolested till the experiment ended; but although the apparatus stood for more than two months, no perceptible influence on the grass was known to occur. It must be observed, however, that on neither grass plot, and especially on the latter, was there a favourable opportunity for a fair and decisive experiment, in consequence of the great number of trees and tall shrubs that stood near to the apparatus.

On Michael Holt's Farm at Didsbury.—The land on which this experiment was made is of a stiff clayey consistence, and this was the third crop since the field was manured, which was with stable and cow-house stuff. The first crop was potatoes, the second wheat, and this third oats and barley. My first visit was on Friday, June 29th. The two suspended wires had got entangled with each other about one-half (southern half) of their lengths. The crops both of oats and barley within the parallelogram of wires, and for a few ridges exterior to it, had a very distinguished appearance from those on any other part of the field. The ridge of oats, both within the under-ground wire and exterior to it at the ends of the enclosed plot, was much taller, had stronger stems and blades, and of a far deeper green colour than any other plot of oats on the field.

The first ridge exterior to the wires (westward) was the next best in point of growth and depth of colour. The third ridge in the series was a little inferior, both in growth and colour, to that last described; and the crop on the fourth ridge was just distinguishable from the rest on that side of the field. Hence, if these distinguishing characteristics in the crop were due to electric action, as I have reason to believe was the fact, the influence was greatest *within* the wires, and spread outwards over three ridges at least, but with diminished effects as the distance increased, until these effects totally vanished by merging into the general character of the crop on the other parts of the land.

With respect to the barley crop which was on the eastern side of the oats, the electrical effects, though eminently distinguishable in the growth of the plants, were much less remarkable than the oats in point of colour. The ridge *within* the wire, even those parts of it exterior to the plot enclosed, was the finest barley in the field, but the colour was only a mere shade deeper than that of the other parts of the crop. The first ridge *outside* the wire was obviously the next best on the barley inside of the apparatus; but the distinction here was nothing like so finely marked as on the oats.

It will be necessary here to remark that the spring season of last year was very cold and dry, and attended by almost continuous east winds, and scarcely any rain had fallen on the field from the erection of the apparatus to the time of my first visit, when the crops assumed the appearances above described. Previously to my second visit to Didsbury, which was on Wednesday, July 2d, a favourable change for the growth of crops had taken place in the weather, which had become warm, showery, and genial. The crops, on every part of the field, had now shot into ear, and displayed a fine healthy condition. The ridge of oats within the wires, and also exterior to the ends of the paral-

lelogram, was still taller and of a deeper green than on the neighbouring ridges, but the difference now was not near so great as before; and on some parts of the field, at a distance from the apparatus, the colour of the oats was quite as deep as that within the wires. The barley was nearly of a uniform colour throughout, but that on the ridge on which the apparatus was placed had still the best appearance.

With respect to the change which had taken place in the appearance of the crops between my two visits, much had necessarily been accomplished by the favourable state of the weather; for, previous to the first visit, the cold, cheerless, dry, easterly winds, although probably highly charged with electric fluid, had rendered the surface of the land arid, hard, and an inferior conductor, by which means the fluid collected by the suspended wires, and conducted to those below, would experience a considerable resistance to its dispersive tendency, and would require a comparatively longer time in spreading to great distances from the apparatus than if the land had been in a more favourable conducting state. Moreover, the air in contact with, and at some distance above the young plants, being dry, would not have that tendency to yield the electric fluid which it held in suspension to the growing crop, as if it had been saturated with moisture, under which circumstances, that part of the crop nearest to the apparatus would receive a greater supply than would be obtained by any other part of the field, and probably not too much for promoting a rapid and healthy vegetation under the prevailing circumstances of the weather.

The favourable change of weather which took place shortly after my first visit would obviously be productive of a corresponding change in all the peculiarities of electric action of the air, land, and crop. The genial showers, laden with electric matter, which fall at that season of the year, soon saturate the land with water, rendering it a good conductor, and supply it abundantly with the electric stimulus. The air, also, being now moist, loses its insulating quality, and becomes more uniformly charged with electric fluid to a great height above the surface of the land, and yields it as abundantly to the pointed and sharp-edged leaves of corn and grass as to other conductors more elevated in their vicinity. Under these circumstances, the wires suspended between the poles lose all their superiority over the plants themselves in drawing electric fluid from the air, and become completely incapacitated for bringing down an extra supply, even if it were wanted, from an upper stratum in which they are situated. Consequently, every part of the land becomes equably and abundantly supplied, and the crop alike stimulated by electrical agency.

Notwithstanding these natural advantages dispensed to the general welfare of the crop, that part of it within, and vicinal to, the apparatus, still maintained a decided superiority even to the time of reaping. I collected specimens of the oats, after being cut, from various parts of the field. The difference, though not so conspicuous in the size of the grain, was very remarkable in the straw, which, in that collected from the remotest parts of the field, shewed it to be about six inches shorter than that collected from about the apparatus; and the average thickness of the stems was less than two-thirds of that of the latter. On counting the grains in a great number of ears in both specimens, the average number on each individual stem was found considerably greater on those plants grown close to the apparatus than on any other in the field, the average number of grains being about 50 on the former and 35 on the others. Several very fine stems were found amongst all the specimens, some of which carried 80 grains of oats; but the generality of those straws taken at a distance from the apparatus carried less than 30 grains. Hence, although the size and quality of the grain were nearly alike on every part of the field, the *quantity*, on an average number of straws, was much in favour of that which grew nearest to the apparatus.

With regard to the relative quantities of grain that grew on equal quantities of land, I have no means of knowing; for no part of the crop was either measured or weighed for that purpose: but the men who reaped it, and also their master, Michael Holt, junior, who has the charge of the farm, told me that the finest part of the crop, *in every respect*, was within the wires and close about them.

The barley crop, however, did not display the same characteristic difference as was observed in the oats; for, although the reapers all agreed that the best crop was close to the wires, I should not be warranted in saying that the specimens which I collected gave a decided indication of superiority in that particular part of the crop, either in the magnitude of the straw or in the quality of the grain; but as I had no means of ascertaining the relative number of corn stalks produced by similar areas of land in different parts of the field, it is possible that the reapers alluded to the weight of the crop as it presented itself to the sickle.

In Sir Thomas Trafford's Park.—In these lands but very little can be advanced in favour of any peculiar mark of electrical influence that was derived through the instrumentality of the apparatus. The field on which the oats grew was, within the last twenty years, the site of a barren moss; and the soil now

being of a spongy vegetable constitution, is well calculated to hold a great quantity of water in suspension, which it does, notwithstanding the extensive drainage to which it has been subjected. Five crops have been gathered since the land was manured. The first crop was potatoes, the second wheat, the third and fourth clover, and the last year's crop oats.

I visited this field, for the first time after the apparatus had been erected, on Saturday, June 21st. The crop looked remarkably healthy over every part of the field, and, whilst standing at a distance, without any perceptible superiority on any particular plot. On walking into the field, however, and pulling several of the best plants I could find from different parts, with a view of comparing them, the difference in their growth was readily discovered. The length of those collected near to the apparatus (first erected) measured, on the average, about three feet three inches from the ground to the tips of the highest leaves, whilst the average length of the others was about two feet five inches, there being a difference of about ten inches. The thickness of the stalks, however, did not correspond with their lengths, being nearly equal in all the specimens.

My second visit to this field was on Friday, the 29th of August. The corn was much laid by the heavy rains that had fallen, and was turning yellow to ripen. No difference in the character of the crop could be distinguished in any part of the field; but, in order to form an idea of the growth of the plants since my previous visit, I measured a great number of the plants, whose average length was upwards of seven feet, so that the growth in about ten weeks was nearly three feet. The crop when shorn was grand in the extreme. It was housed in the second week of September. I was at the farm at the time, to make inquiries of Mr Jackson and his men. Nothing remarkable relative to the crop, beyond that of its unusual fineness, had been observed by any of them; but a circumstance of a very singular nature had been noticed whilst reaping it. A splendid crop of thistles, which had no parallel in the field, was met *within* and *about* the wires.

To the reader who has paid attention to the principles of electricity which appear in the preceding section, the uniformity of the crop, in this case, will be easily accounted for. The wet character of the land would afford every facility for a rapid dissemination of the electric fluid which arrived at it, whether through the medium of rain, the plants, or the apparatus, and every part of the field would almost equally partake of its influence. In every case, however, when the air is dry, the apparatus will collect and carry down to the land an immense quantity of fluid which otherwise it could not obtain. Therefore, under

these circumstances, the *intensity* of the electric action will always be greatest about the under-ground wires, whatever may be the nature of the soil in which they are placed. But as the accumulation of fluid and consequent intensity of electric action at the bottom of the apparatus will be inversely as the conducting character of the land, the influence of that action on dry land ought always to be more conspicuously marked in its limitations about the apparatus, than on wet land, over which it would be more rapidly and generally distributed. A comparison of the results first observed on the dry hard clayey land at Didsbury with those obtained on wet spongy land in Trafford's Park seems well calculated to develope an open declaration of the justness of these beautiful laws of electricity, whilst the novel and remarkably interesting character of the facts themselves may tend to exalt the cause of science, and become useful landmarks in this its peculiar application.

I was particularly unfortunate with the reticulated apparatus representated by Fig. 7. Its weight, together with the force of the wind to which it was exposed, had stretched the wires to such a degree, that I found it hanging amongst the corn-plants on my first visit, so that I paid no further attention to it.

On the Grass Field at Kirby Lonsdale.—As I had no opportunity of visiting Kirby Lonsdale whilst the grass was growing, nor any knowledge whatever respecting its progress till November, the interesting report that I have to make in this case is founded solely on the information which I received directly from Mr Fisher himself, whom I visited at the vicarage on Saturday the 8th. It appears that a remarkably fine plot of grass, of a rectangular figure, and much superior to any other in the field, crossed the under-ground wires at nearly a right angle, and extended eastward to a considerable distance, and upwards of 50 yards westward of the wires. This plot of grass had its longest sides nearly at right angles to the magnetic meridian, and its breadth within the wires, or nearly so, and reached considerably farther westward than eastward.

After obtaining this information from Mr Fisher, I met William Muckald, his servant, who assisted in erecting the apparatus and in mowing the grass. Muckald corroborated Mr Fisher's statement in the following emphatic provincial style—"Wy, I niver sa t'like in o me life; it beat o t'other cet field far enough. John Hodghson help'd ta maa it, en when we cam tet thick spot, he sed, 'dam t'wires, t'gerss is sa thick I can hardly maa it.' En I's sure it capt ought et iver I saa; that it did."

At Casterton Hall.—In this case I have but little to say, either

in favour of the experiment or otherwise. I have had no opportunity of seeing the crop myself, nor of hearing anything about it, excepting through the medium of a note from my friend Mr J. Forster of Kirby Lonsdale, to whom I wrote to make inquiries respecting the result. Mr Carus Wilson had informed him that "he saw no improvement, or if any, very slight," on that particular plot enclosed by the wires. Mr Wilson "attributes it to the land having been previously excessively manured."

7. *Remarks, and Practical Rules for Future Experiments.*

As the experiments which I have myself made on farm-crops were undertaken for the developement of facts only, I have, in these first trials, strictly conformed to the plan of operating first brought into use at Findrassie, being well aware that whatever might be the results, my labours would be less liable to censure than if I had pursued a different course. Moreover, as it often happens in experimental inquiries that the best method of getting hold of the clue of truth is to pursue the same route that has led others to success, it would have been unwise to have deviated materially, in any trial, previously to an acquaintance with the fruits that were to be met with in the paths already pointed out.

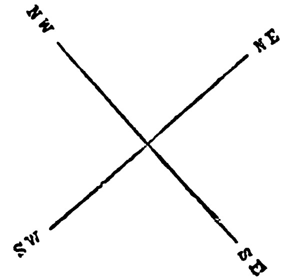
Having nothing in view beyond the cause of truth, I have been particular in giving a faithful report of every fact of consequence attending these experiments, that have directly or indirectly come to my knowledge, whether they may appear favourable or unfavourable indications of enhancing the productions of the land by this mode of treatment. That the experiments might assume a practical form, easily repeated by the farmer, and under circumstances most likely to be interesting to him and to secure his attention, they have all been made on a large scale, on different soils and crops, and in districts wide apart from each other. The results have varied in a considerable degree and in a very remarkable manner; for, although an electrician might easily have foretold that the influence was not likely to be fenced in by the under-ground wires, and wholly limited to the enclosed area, its stretching *westward* more particularly than in any other direction, as was obviously the case at Didsbury and Kirby Lonsdale, is a circumstance perfectly novel in the catalogue of electrical phenomena, and has no parallel in electrical science.

M. Ampère, a French philosopher, about the year 1821, advanced an hypothesis to account for the magnetism of the earth, by supposing a continuous flow of electric fluid round its axis from east to west; but as these imaginary currents have yet to be discovered, the peculiar distribution of electric influence above

noticed, cannot with propriety be referred to any such cause, until more facts become developed to shew that they absolutely exist. If continuous electric currents, from east to west, traversed the air alone above the earth's surface, the needle would have the opposite direction to that it now places itself in, or its present north end would, under those circumstances, become its south end, according to the principles of electro-magnetism. If, however, at the same time, more powerful currents traversed the body of the earth in the same direction, the needle would obey the latter, and assume its present well-known position. But as the needle does not change its position either in the deepest mines or at the greatest atmospheric altitudes hitherto arrived at, there is no evidence of electric currents in the air; and if any exist in the earth to which its magnetism is due, the most powerful of their forces must be situated at greater depths beneath the surface than have yet been explored.

Since, then, there is no reason to believe that a continuous electric tide in the air sweeps the surface of the land from east to west, nor any means at our disposal of confining electric influences within the limits of a marginal wire in the ground, there is no authority from facts for making choice of the magnetic meridian as a more advantageous position than any other for the suspended wires to be placed in, nor ought it to be expected that any gain is to be derived by bordering a plot of land with those that are under ground. The prevailing winds ought to be attended to when selecting positions for the suspended wires, and those under ground ought to branch out in various directions, to facilitate an extensive distribution of the fluid over the land.

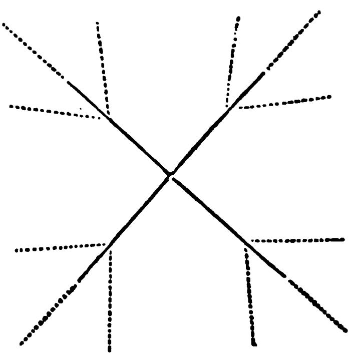
The prevailing winds in most parts of Great Britain are easterly in the spring season and westerly during most part of the summer; therefore, a pair of wires stretched in a N.E. and S.W. direction, and another pair beneath or above crossing them at right angles, near the middle, as represented by Fig. 8, would probably form as good a system for the suspended portion of the apparatus as any that could be suggested. The wires, in all cases, ought to be of copper, because of its superior conducting character and its capability of withstanding the action of damp air and moist ground, and the upper portion elevated as high in the air as is practi-



cable; and as tall trees rob the air of a considerable amount of fluid, the suspended wires ought not to be situated near them. The system of wires here recommended would require either four or five poles for its suspension, according to its extent. If each strand of wire be not more than 50 yards long, four poles (one at each end) will be sufficient; but if much longer, it will be necessary to have the system supported at the intersecting point by a fifth pole; because long wires, if not sufficiently supported, bend downwards considerably, and cannot be kept at a proper height. The supporting poles may be of any kind of wood, and either seasoned or not; for as the object is to electrify an extensive surface of land, and no insulation required, it is a matter of no consequence whether the fluid descends by means of the poles or through the instrumentality of the branch-wires.

The principal wires at the bottom of the system, which receive the fluid at the ground, ought to stretch from pole to pole, directly under those suspended above; and from these *main wires* or *prime conductors* other wires ought to proceed in various directions, especially on dry land. Fig. 9 will illustrate a system of wires well adapted for distributing the fluid to a considerable area of land. The situations of the poles are at the ends of the black lines which cross each other, and the black lines themselves are the *main wires* or *prime conductors*. The dotted lines shew the directions in which the branch-wires proceed from their respective *prime conductors*.

Fig. 9.



Although on wet land it might not be absolutely necessary to have the bottom wires placed beneath the surface, yet on dry land there would be an advantage in having them buried even four or more inches deep, in order that they may be in contact with moist mould, and thus facilitate the dissemination of the fluid; and, for security's sake, it would be well to have them under ground on all lands, whether wet or dry. The branch-wires which descend from those that are suspended may be twisted a few times round their respective poles to secure them against injury, and they should form a good connexion at the bottoms of the poles with the under-ground wires. In very extensive fields it may be necessary to have two or more apparatuses

erected, for the purpose of collecting a sufficient quantity of fluid to produce the best effect, or one individual system may be so extended, by means of additional poles and wires, as to answer the same purpose. In every case the apparatus ought to be erected early in the spring season, in order that it may be serviceable during the dry weather that often prevails for several weeks after seed-time.

There is a remarkable circumstance which generally, though not universally, presents itself in corn fields, viz., the head lands, or end ridges, produce the best crops. I have heard various attempts at explanation by very intelligent farmers, but none that have appeared satisfactory. Some ascribe the circumstance to those parts of the field being most trodden by the horses; others, that it is in consequence of an accumulation of the best mould, brought from the other parts by the plough; and others again allude to the shelter and shade afforded by the fences. The latter explanation would certainly look most feasible if the best crops were always found on the southern sides of the fields and close to the highest fences, which is not the case; therefore the effect must proceed from some other cause than shading. Luxuriant hedges, whether high or low, collect immense quantities of electric fluid from the air, and conduct it to their roots, where they yield a portion to the soil in which they grow. Tall trees supply the land still more abundantly in proportion to the extent of their foliage; and it is very remarkable that corn is generally most luxurious close to the site of trees that happen to be growing in hedges; unless they be ash trees, which, in most cases, produce the opposite effect. I have observed the different effects on crops that different kinds of trees produce in many instances; but in none have I seen the contrast so regularly and strikingly marked as in a hedge bordering one side of a corn field in Coverdale, Yorkshire, during last summer. The hedge was studded with fine trees, about twenty in number, and alternately elm and ash. Opposite every elm the crop was more luxuriant than in any other part of the field, and of a fine deep green colour; whilst that which grew opposite the ash trees was very much inferior to any of the rest. Indeed it looked completely dwarfish, thin, and dingy, when compared with its alternating fine well-grown patches that appeared within the influence of the elms. I visited the spot several times for the purpose of gratifying my curiosity on this interesting spectacle, as well as with a view of discovering some clue to the cause. But although I took a minute and careful survey of surrounding circumstances, such as the effects of trees and tall hedges in the neighbourhood, and the different aspects of crops at a distance from fences of every kind, and have since exer-

cised much thought on the subject, I must confess that I am still at a loss respecting the baneful influence of the ash; and all that I can learn from the farmers is, that "the ash is a poisonous tree." There are instances, however, in which good crops grow under ash trees, so that its supposed poisonous qualities are not universally attended with the same effects; nor, indeed, are we led much nearer to the true cause by merely entertaining the idea of a malignant quality being a residentiary peculiar to the ash. The influence of trees on crops forms a topic of great importance both to the philosopher and the farmer; and if the latter were to undertake an extensive series of observations, and faithfully record the facts that fall within his notice, the pioneering part of the business would soon be accomplished, and much valuable data would be collected for the contemplations of the philosopher.

Much credit is already due to farmers for advancing their art to its present elevated position; for although chemistry has materially assisted in the cultivation of land, it has chiefly been in the discovery of the elements of such food as, by long experience, was found most beneficial to the health and growth of the vegetable productions of the land, and in pointing out novel sources of supply; whilst all the experience of value has emanated from the farmer's own modes of operating, independently of any aid from the laboratory chemist, whose services are, of course, of a subsequent date. The rules of his art will always enable the practical chemist to be of much service in providing food for plants, although it may require a higher order of investigations than those he is in the habit of pursuing to discover the characters and operations of those forces which stimulate the organs of vegetables to avail themselves of the food thus supplied for their use. If, as is now generally admitted, the functional powers of plants have an electric origin, the investigation necessarily devolves upon the experienced electrician, in whose province alone are these forces to be contemplated to advantage. It would appear, indeed, from the multitude and variety of facts that have obtruded themselves on the notice of philosophers, that it is the electrician's province in which the basement of vegetable physiology is most likely to be permanently laid; where the fundamental principles of scientific farming are to be framed; and, consequently, from which must ultimately flow the greatest blessings that the earth can confer upon man.

P.S.—Since the preceding essay was completed, I have had an opportunity of reading, in the "Edinburgh Philosophical Journal," a paper from the pen of Dr Fyfe, in which appears a long catalogue of experiments carried on under his own superintendence,

and as it is highly probable that such a long list of unsuccessful experiments may have a very different effect on many readers to that which the author is desirous it should produce, a few conciliatory remarks may be useful in this place. In alluding to the wires' action on the magnetic needle, our author did not succeed in obtaining any deflections as had been observed by Dr Forster. Now, as it is possible that the magnetic action in question was due to the *iron wire* employed at Findrassie, Dr Fyfe's *copper wire* would not produce a similar result. And if the deflections at Findrassie were due to electric currents, which is not likely, that would be no reason why similar currents should be traversing Dr Fyfe's wire at the precise time that the observations were made. The electroscope tests which Dr Fyfe resorted to determined nothing farther than what an electrician would have predicted where no insulation was concerned. That the galvanic experiments produced no remarkable results is a circumstance not to be wondered at, since, if any electric action took place, it could only arise from a slight disturbance of the electric fluid natural to the mould between the copper and the zinc plates, which would neither augment nor diminish the original quantity.

THE FARMERS' NOTE-BOOK.—NO XI.

Loudon's Self-Instruction for Young Land-Stewards, &c.*— It will be seen, by the date given below, that this is a posthumous publication, the last, in all probability, that will be enriched by any of the previously unpublished writings of the esteemed Mr Loudon. Two years have already elapsed since his active, industrious, and eminently useful life reached its close, and this is a further contribution to the immense mass of valuable matter for which the public have long been, and still are, his debtors. It is not easy to estimate the influence which his numerous works have exercised on the various departments of rural economy of which they treat. We are in the full possession and enjoyment of many of the benefits which resulted from his indefatigable labours, and we do not in this instance belie our habitual character of being somewhat indifferent as to the source from which we originally derived them. But it is impossible to consider the

* Self-Instruction for Young Gardeners, Foresters, Bailiffs, Land-Stewards, and Farmers, in Arithmetic and Book-Keeping, Geometry, Mensuration, and Practical Trigonometry, Mechanics, Hydrostatics, and Hydraulics, Land-Surveying, Levelling, Planning, and Mapping, Architectural Drawing, and Isometrical Projection and Perspective: with Examples, shewing their Application to Horticultural and Agricultural Purposes. By the late J. C. LOUDON, F.L.S.H.S., etc. With a Memoir of the Author. Illustrated with numerous engravings. London: Longman and Co. 1845.

nature and extent of Mr Loudon's works—the immense mass of information they convey on almost every department of landscape-gardening, horticulture, arboriculture, agriculture, many branches of natural history, rural architecture, and other similar subjects—the fulness of detail, and encyclopediac range of intelligence with which they are treated, and nearly all illustrated by such a profusion of beautiful engravings, (printed along with the text, a method which, though now so familiar to us, he was the first to practise on a large scale,) that the descriptions cannot fail to be at once comprehended, while the objects themselves are, as it were, stereotyped and stamped on the mind with a durable impression. It is impossible to advert to these and other similar considerations without being at once convinced that the influence of Mr Loudon's works has been most extensive and beneficial. Many of them appeared at a time when the subjects they treat of were very imperfectly understood in this country, and there is every reason to believe that it is in a great measure owing to the impulse thus communicated that they owe their present state of comparative advancement.

The present work is of an elementary character, and will be found of great utility to young men who have either received an imperfect rudimentary education, or have forgotten, in a great measure, what they had learned. Certain branches of arithmetic, book-keeping, practical geometry, mensuration, practical trigonometry, land-surveying, architectural drawing, and other similar topics, are the subjects treated of. A melancholy interest attaches to the work, as being the last in which its lamented author was employed: he continued dictating portions of it till twelve o'clock on the night before his death. To Mr Loudon's numerous friends and pupils, the most interesting feature in this volume will be the memoir of his life—with a portrait prefixed to it—written by his widow. This interesting sketch makes us acquainted with the principal occurrences of his life—his methods of study—and the numerous literary undertakings in which he was engaged. We cannot forbear from recording a few biographical particulars respecting this eminent individual, in the pages of a Journal devoted to a subject which, along with the many others with which it is more or less intimately connected, he did so much, both by his writings and practical labours, to extend and promote.

John Claudius Loudon was born at Cambuslang, in Lanarkshire, on the 8th April 1783. His father was a farmer, and resided, at the time the subject of this notice was born, at Kerse Hall, near Gogar, in the vicinity of Edinburgh. Young Loudon shewed an inclination for gardening when very young, and his greatest pleasure, during his early boyhood, was in making walks and beds, and rearing plants in his father's garden. Anxious to

obtain for him the advantages of a liberal education, his father sent him to Edinburgh for the purpose of attending the public schools. Here he acquired some knowledge of classical learning, for which he had shewn a strong repugnance, and made himself acquainted with French and Italian. Drawing was at this period his favourite pursuit, and in this he made such proficiency, that he was qualified at an early age to become draughtsman and assistant to Mr John Mawer, at east Dalry, near Edinburgh. He subsequently resided for several years with Mr Dickson, nurseryman in Leith Walk, and during that time he attended classes on botany, chemistry, and agriculture, in the Edinburgh University. He was noticed at this time for the diligence with which he prosecuted every branch of study on which he entered. Such was his desire of improvement that he regulary sat up two nights every week to study, drinking strong green tea to keep himself awake. This practice he continued for many years.

He repaired to London in 1803, and began to occupy himself professionally as a landscape gardener. In this he was eminently successful, finding abundance of employment in many different parts of England. Through the influence, probably, of Sir Joseph Banks, who always continued to be his warm friend, at whose house he occasionally met most of the scientific men of the day, he was early elected a member of the Linnean Society. Mr Loudon's first work appears to have been suggested to him while employed in Scotland, in 1804, laying out grounds for various noblemen and gentlemen, in particular the Earl of Mansfield, who was then altering and improving the palace gardens at Scone. The book alluded to was entitled, *Observations on the Formation and Management of Useful and Ornamental Plantations, on the Theory and Practice of Landscape Gardening, and on Gaining and Embanking Land from Rivers or the Sea.* This work was published in Edinburgh by Constable & Co., and by Longman & Co., London, with the latter of whom Mr Loudon continued to transact business of this kind for nearly forty years. This was succeeded, in 1805, by another publication, entitled, *A Short Treatise on some Improvements lately made in Hothouses.* A more important work than either of these appeared on the following year, ornamented by some elegant copper-plate engravings of landscape scenery. This was his *Treatise on Forming, Improving, and Managing Country Residences, and on the Choice of Situations appropriate to every class of Purchasers, &c.*

The year 1806 was marked by an occurrence which proved a source of great annoyance to Mr Loudon, not only at the time it happened, but during the whole of the remainder of his life. While travelling in Wales, he caught a violent cold by being exposed all night on the top of a coach to the rain; this brought on rheumatic fever, which finally settled in his left knee, an

from improper medical treatment, terminated in a stiff joint. While suffering under the immediate effects of this calamity, which befell him in the prime of his days and the vigour of his power, his mental energy continued unabated; he painted landscapes, learnt German, paying his expenses, as he had done before when he learned French, by selling for publication a pamphlet he had translated by way of exercise; he also took lessons in Greek and Hebrew. A farm called Wood-Hall, where he stayed during his illness, being to let, he induced his father to rent it, with a view of improving the state of husbandry, which was then in a wretched state in many parts of England. The attention he was thus led to pay to Agriculture was the means of inducing him to embody his opinions on this subject in a pamphlet published in 1808, entitled, *An Immediate and Effectual Mode of Raising the Rental of the Landed Property of England, and rendering Great Britain Independent of other Nations for a Supply of Bread-corn.* He afterwards took another farm, called Great Tew, not far from Oxford, where he established a kind of agricultural college for the instruction of young men in agricultural pursuits, being desirous of securing a permanent source of income, in case his auchylosed knee should prevent him carrying on his favourite pursuit of landscape gardening. In 1809 he published a pamphlet, giving an account of this institution, and pointing out the utility of agricultural knowledge to the sons of the landed proprietors of England, and to young men intended for estate agents.

By the exercise of his profession as a landscape gardener, diligently prosecuted, not only in England and Scotland, but also in Wales and Ireland, Mr Loudon had amassed a considerable sum of money—upwards of £15,000; and when the continent was thrown open to English visitors, by the general rising against Bonaparte in 1803, he resolved to relax his exertions for a time, and gratify his ardent thirst for knowledge by travelling abroad. He accordingly repaired to Sweden, Prussia, Austria, and Russia; visited the two capitals of the latter country, arriving at Moscow on the 4th March 1814, while the buildings were yet black with the famous conflagration. Of the various difficulties he encountered on the road, we may mention the following:—

Once the horses in his carriage, being unable to drag it through the snow-drift, the postilions very coolly unharnessed them and trotted off, telling him that they would bring fresh horses in the morning, and that he would be in no danger from the wolves, if he would keep the windows of the carriage close, and the leathern curtains down. There was no remedy but to submit; and few men were better fitted by nature for bearing the horrors of such a night than Mr Loudon, from his natural calmness and patient endurance of difficulties. He often, however, spoke of the situation he was in, particularly when he heard the howling of the wolves, and once when a herd of them rushed across the road close to his carriage. He had also some doubts whether the postilions would be able to recollect where they had left the carriage, as the wind had been very high during the night, and had blown

the snow through the crevices in the curtains. The morning, however, brought the postilions with fresh horses, and the remainder of the journey was passed without any difficulty.—P. 23.

After his return from the continent, he unfortunately embarked in mercantile speculations, and underwriting ships at Lloyds, by which he lost nearly the whole of the money he had accumulated by his professional labours. About this time his health began to be seriously impaired, and he took a house at Bayswater, called the Hermitage, with a large garden annexed, which continued to be his residence till his death. He now seems to have devoted his time chiefly to his pen. He projected his *Encyclopedia of Gardening*, and, in order to collect materials, visited France and Italy, although his health was at this time in a very precarious state. This well-known work appeared in 1822; it had an extraordinary sale, and fully established the literary fame of its author. In 1825, the *Encyclopedia of Agriculture* was written and published. The preparation of these laborious works in such rapid succession, (for a second edition of the *Encyclopedia of Gardening*, almost wholly rewritten, appeared in 1824.) speak strongly to the indomitable energy of his mind; for his bodily health was at this time in a lamentable state. His right arm had been broken a second time, and he suffered so severely from the pain, that he found no ease but from the use of laudanum, to which he became at last so habituated, that he took *a wine glassful every eight hours*. After the amputation of his arm, however, he speedily cured himself of this dangerous habit without experiencing any inconvenience.

The *Gardener's Magazine*, a work with which his name is more particularly associated in the minds of the practical gardeners of this country, was established in 1826. This was his favourite work, the organ through which he communicated his own thoughts and feelings to the public. It met with a most favourable reception, 4,000 copies of the first number having been sold in a few days, and it continued to enjoy a high degree of popularity till its close at the death of the conductor. Two years afterwards he began the *Magazine of Natural History*, the first work of the kind, we believe, ever published in this country. It also was favourably received, and had a considerable sale.

The writer of the memoir from which these memoirs are extracted, describes the occasion of her first introduction to Mr Loudon. This she must be permitted to do in her own words:—

My father died in 1824, and finding, on the winding up of his affairs, that it would be necessary for me to do something for my support, I had written a strange and wild novel called *The Mummy*, in which I had laid the scene in the twenty-second century, and attempted to predict the state of improvement to which this country might arrive. Mr Loudon chanced to see the review of this work in the *Literary Gazette*, and as, among other things, I had mentioned a steam plough, it

attracted his attention, and he procured the work from a circulating library. He read it, and was so much pleased with it, that he published, in the *Gardener's Magazine* for 1828, a notice of it under the head of "Hints for Improvement;" and he had from that time a great desire to become acquainted with the author, whom he supposed to be a man. In February 1830, Mr Loudon chanced to mention this wish to a lady, a friend of his, who happened to be acquainted with me, and who immediately invited him to a party, where she promised him he should have the wished for introduction. It may be easily supposed that he was surprised to find the author of the work a woman; but I believe from that evening he formed an attachment to me, and, in fact, we were married on the 14th of the following September.—P. 35.

But our space will not permit us to enter much farther into details, nor even to indicate all the works which he laid before the public. In 1832 he commenced his *Encyclopedia of Cottage, Farm, and Villa Architecture*—one of the most useful of all his productions. In the preparation of this work his wife acted as his sole amanuensis; and for several months he and she used to sit up the greater part of every night, never having more than four hours' sleep, and drinking strong coffee to keep themselves awake. This work was published on the author's own account; and the great success that attended it tempted him to publish the *Arboretum Britannicum* in the same manner. This latter undertaking gradually expanded under his hands, and it was his determination to make it as perfect as possible that involved him in the pecuniary difficulties which, to all appearance, hastened his death. As all the drawings of trees for the Arboretum were made from nature, he had seven artists constantly employed, and he was frequently in the open air with them from his breakfast at seven in the morning, till he came home to dinner at eight in the evening, having remained the whole of that time without taking any refreshment, and generally without even sitting down. After dinner he resumed the literary part of the work, and continued writing, along with his wife as his amanuensis, till two or three o'clock in the morning. He had three other monthly works besides the Arboretum going on at the same time. During this period of extraordinary exertion both of mind and body, he was suffering under what was supposed to be a liver complaint, and an enormous swelling in his right knee. When the Arboretum was completed, he found that he owed *ten thousand pounds* to the printer, stationer, and wood-engraver who had been employed in the undertaking. The work, along with Cottage Architecture, was placed in the hands of Messrs Longman & Co., to hold for the creditors till the debt should be paid by the sale.

Subsequently to this period, Mr Loudon visited France and Scotland. While in the latter country he was seized with a severe bilious fever. On his recovery he visited various places in the southern division of the country, carfully examining the principal gardens, and making notes of all he saw. On his return

to England, the first number of the *Encyclopedia of Trees and Shrubs* made its appearance; and, in 1843, his work on *Cemeteries*, on which he bestowed much pains, and which was very expensive, owing to the number of engravings. Mr Loudon had an attack of inflamation in the lungs on two different occasions. In 1843 his lungs again became diseased, and that so seriously, that he appears by the end of September in that year to have lost hope of ultimate recovery. Even in these circumstances he laboured almost night and day to finish the works he had on hand; and that, too, notwithstanding the agitation attendant on the numerous letters and consultations respecting his pecuniary affairs. On the 13th of December

He appeared very ill, (says his widow,) and told me he thought he should never live to finish *Self-Instruction*, but that he would ask his friend Dr Jamieson, to whom he had previously spoken on the subject, to finish the work for him. Soon after this he became very restless, and walked several times from the drawing-room to his bedroom and back again. I feel that I cannot continue the melancholy details: it is sufficient to say that, though his body became weaker every moment, his mind retained all its vigour to the last, and that he died standing on his feet. Fortunately, I perceived a change taking place in his countenance, and I had just time to clasp my arms round him, to save him from falling, when his head sank upon my shoulder, and he was no more.

Improvement of Farm-yard Manure. By Mr MAIN.—From the year 1803 to that of 1808 I had the charge of a farm on which a very superior style of business was carried on. It comprised above 400 acres of arable pasture and meadow; the soil varying from gravel to a light loam. The surface was considerably undulated with easy swelling knolls, and gentle hollows between, the eastern slopes being invariably the best and deepest loams, while the western brows were sharp gravel. A small lively trout-stream traversed the farm from west to east, and the level meads on each side bore heavy crops of hay, but of rather a coarse character. Both the meadows and pastures were better calculated for light than for heavy live stock: Southdown sheep and the smallest sized short-horn oxen were found best adapted for the natural powers of the land. It was resolved to improve the character of the estate by every practicable expedient. Draining was extensively executed; cumbrous old fences were grubbed up, and new hedges planted. But the natural poverty of the land could not be improved otherwise than by bestowing on it liberal dressings of the richest manure, and this could not be had either cheaply or conveniently, except by entering on a comprehensive system of cattle-feeding in all its branches. Hence a quadrangle of feeding houses, sufficient to tie up at the same time nearly forty head of cattle, were erected on the most approved plan, far superior to anything of the kind that had ever been erected in England before. Each stall was

fitted up with a cistern, manger, and hay-rack. At the ends of each range of stalls were pumps, store-rooms for fodder, cake-machine, and drawers for holding mixed manger meat, which were easily transferred to the feeder's barrow, and wheeled along a passage at the heads of the cattle when fed. The greater number were haltered, but six of the forwardest were loose in boxes, and consecutively sent to market as they became fit for the butcher.

At one side of the quadrangle the piggery was placed, and a very complicated building it was. In the centre there was the pigs' kitchen, fitted up with a large copper, various binns, and surrounded on three sides by separate styes, into which shoots were led from the kitchen, so that the feeder could serve the whole stock without quitting the kitchen.

Over the kitchen and centre of the quadrangle was erected a granary supported on posts; and around which a sloping roof was extended ten feet outwards, its eaves supported by posts also, the whole forming a large covered space, into which all the dung from the stables and feeding-houses was brought, and daily and regularly piled in horizontal layers, all over the floor under the roof, so that neither sun to dry nor rain to wash the manure were admitted to deteriorate it, or extract its fluid qualities. Nor was this all; a capacious water-tight cistern was sunk at one side of the bed of dung, which received all the rich drainage from the stables, feeding-houses, and styes, as well as the oozings from the dung itself. In the cistern a lofty pump was erected, which served to empty the cistern, and, by means of spouts of various lengths, conveyed the contents of the cistern over the whole body of dung every morning, so as to keep it always completely saturated with its own liquor. This was a part of the feeder's duty, and therefore never neglected. The arrangement of the buildings for the abridgement of labour, for the convenience of preparing the food, and feeding the cattle, and for the comfort and wellbeing of the animals themselves, were all admirable. But no part of the plan was more economically excellent than that of preparing the dress for the field crops. Prepared as it was, it could not be otherwise than rich, because much lintseed cake was used as well for sheep as for cattle, there being a crushing mill of three presses on the estate, built entirely for supplying the feeding-houses. The value of this concentrated manure was clearly evident by the magnificent crops of turnips, barley, clover, and wheat, which invariably followed its application; and I had the most convincing proofs, in after years, that a coat of that feeding-house manure continued visibly serviceable to the crops for *nine years* afterwards, without any repetition of this or any other description of dress whatever.

The same accomplished agricultural economist and architect,

Mr Thomas Howse, (a native of the Vale of Aylesbury, and a contemporary of the eminent graziers and feeders, Messrs Westcar, Grace, &c. names so conspicuous in the annals of the "Smithfield Club," of that part of the country fifty years ago,) was equally attentive to the comfort of the fattening sheep in the open air as he was to the cattle in the houses. He invented portable hovels of extremely thin and light materials, formed in pannels, and united by hooks and staples, which could be put up or taken down in a few minutes by the shepherd and his boy. Each divison of the hovel had its own little rack for hay, and trough for sliced turnips, chaff, or cake. In bad weather, and especially if wet, or when snow was on the ground, it was quite delightful to see how the sheep enjoyed themselves under this temporary erection, and which greatly assisted their arriving at a marketable condition.

While the whole of this system was carried on, during the war, it was profitable; but the steward dying in 1802, the system was relaxed under the new steward, and in 1808, the farm and oil-mill were let, and the feeding establishment broken up. But the advantages and effects of the feeding system were ultimately enjoyed by the landlord, whose rental was advanced from 12s 6d. and 20s. to 25s. and 35s. per acre, at which rental it still remains in the parish books. This was the result of the attempt to improve one of the poorest gravelly spots in England; and though the object was so far gained as to prompt the barren gravels to yield remunerating crops, it was perfectly obvious that without frequent applications of feeding-house dung, these hungry gravels could not be kept sufficiently fertile to pay accompanying expenses.

Another thing which rendered stall-feeding on such a locality unprofitable, was the absence of rich pasturage, on which the beasts might have been made half fat before being tied up; for stall-feeding entirely on artificial food rarely pays the feeder. And it is only when rich pastures are united with judicious stall-feeding that any handsome return can be realized in fattening beef for the shambles. Even the celebrated prize cattle seldom bring anything but *honour* to the exhibitor; but at all the principal feeding stations for the London Christmas market, we invariably find the richest pastures around the feeding-houses.

In the foregoing observations there is not anything of practical value, except it be that relative to the management of farm-yard dung. The idea of keeping manure in the shade is good, because it is quite evident that the humid riches of the dung are quickly dissipated by the sun's heat and light. And placing it so as to drain itself is also proper; because if too much drenched with water, whether from lying in a hollow, or too much exposed to

rain, it is always inferior, from not undergoing the necessary fermentation. The rich juices of the dung, however, should always be preserved by some means or other, and not allowed to run to waste, which is too often the case. Although there are but few farmers who can prepare their dress as described above, yet, as the principle is sound, it is worthy of imitation whenever or wherever practicable.

It may be added, in conclusion, that, when too much refinement is recommended to be introduced into the homely business of farming, and though such advice may be philosophically, and even practically right, yet it can scarcely be expected that such rules can be readily adopted by the generality of farmers, who will, as usual, compound their dung-heaps upon a base of absorbent earth, and content themselves with a covering of the same; both as preventive of the escape, and retentive of the fugitive fluids.

AGRICULTURAL REPORT.

February 1846.

The last four weeks, embracing the latter end of January and as much of February as has already passed, (19th,) have presented such a continued phenomenon of beauty of sky and pleasantness of temperature as we never remember to have witnessed at this season. The temperature was not high, as indicated by the thermometer in the shade, and there were cool days decidedly frosty, and even slight showers of snow had fallen. A flood of sunshine and agreeable temperature thus appearing every day, vegetable life has been excited into action, so that the young grass grows apace; the young wheat, being daily sown, is pushing its spike vigorously through the soil, and more good pasture has been ploughed down in the lea than we have seen growing for the subsistence of stock in the height of summer. In the midst of so much excitement, the turnip-tops are pushing into flower, in those cases where the farmer has not followed the provident plan of storing, and in the case of the turnips left in the ground for sheep, in such a season as this, the stems should have been removed, or, what is better, stores of turnips should have been made in the field, and the bulbs cut into pieces for the sheep by a machine, rather than have allowed the plants to exhaust their nutrition by flowering. Such has been the greatness of the crop of turnips, that some farmers, it is stated, will find it difficult to have them consumed by their stock.

The market for fat stock continues high, and that for grain

has so far recovered from its fright, as to settle down near to the rates of last year, and only a little higher than the Continental prices; and it is questionable that the price of grain will fall any lower, seeing that few supplies can be obtained from the Baltic, and the distance from America is too great for large ones to arrive in a short time.

Our readers have long since been made aware of the intentions of Government in regard to the corn-laws. These are doomed to die an unnatural death in three years, and after that period, our farmers *must* suffer to be jostled by foreign competitors in their own markets. What may be the ultimate effects of withdrawing protection from our agriculture, no one can foretell. God grant it may not check that spirit of enlightened culture which was about to be generally adopted. That it will enervate the timid and paralyze the desponding there is too much reason to fear, but we hope that as success attends the confident and the sanguine, their example will in the end determine every farmer to maintain the vantage-ground they at present enjoy. Stock should be made to continue, as it is, the main stay of the British farmer, and we have no doubt will continue to be so, notwithstanding the importation of stock from abroad. The means of fattening stock abroad are so limited, and cannot be extended but by very great improvement in agriculture, that we conceive the effect of the reduction of duty will cause the import of young and lean stock rather than of fat, and the grazing and fattening of this lean stock will bestow the profits arising therefrom on our own people.

The cry of famine soon died away. Having been raised for a political purpose, it was silenced when that purpose was served. Alarming as the disease of the potato at first seemed, it was soon arrested, and the price of that now indispensable produce of our fields has subsided to its usual rate in the potato-growing districts, such as at Perth. It has been ascertained by the Chemistry Association that the loss sustained by the disease has not exceeded one-sixth of the crop; and as the crop was estimated at one-fourth above the average, there remains a sufficiency for the use of the people; and yet it is still maintained that a deficiency exists in Ireland. We have, of late, had frequent opportunities of observing that potatoes have been left in the ground in e ery other drill; and on inquiring how they had kept in the ground, it seems not better than in the pits.

In regard to the corn-laws, our belief is, that had they conformed themselves to the peculiar circumstance of this year—had they admitted the *good* wheat of foreign growth into the market at a low duty—they would have been allowed to remain unmolested for an indefinite number of years. The peculiar circumstance alluded to was the anomaly of fine wheat being concurrently

presented at market with coarse from the same crop. The natural consequence was, that a high price for the fine and a very low one for the coarse were placed in juxta-position: and as the coarse greatly preponderated in quantity, its price held the averages down, while it kept the duty high, when, in fact, good wheat was really wanted for mixing with the bad. This was the trying occasion for the graduated scale, and indeed it was an occasion in which no sort of scale could possibly be made to conform itself to it. In every other respect, the present law has operated well, having put down the nefarious working of the averages, and at the same time afforded a larger protection for a longer time than any former law ever did. In short, it was doubtless its pertinacity in affording ample protection under all circumstances that was the true cause of its condemnation by its own proposers.

THE REVENUE.

ABSTRACT of the Net Produce of the Revenue of Great Britain, in the Quarters and Years ended on the 5th of Jan. 1845 and 5th of Jan. 1846—showing the Increase and Decrease on each head thereof.

	Quarters ending Jan. 5. 1845.	1846.	Increase.	Decrease.	Years ending Jan. 5. 1845.	1846.	Increase.	Decrease.
	£	£	£	£	£	£	£	£
Customs	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	- -	[illegible]
Excise	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	- -
Stamps	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	- -
Taxes	[illegible]	[illegible]	- -	[illegible]	[illegible]	[illegible]	[illegible]	- -
Post Office	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	- -
Miscellaneous	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	- -
Property Tax	[illegible]	[illegible]	- -	[illegible]	[illegible]	[illegible]	- -	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]					[illegible]
	Increase on the Qr.		[illegible]		Decrease on the Year,			[illegible]

FOREIGN MARKETS, per Imperial Quarter, free on Board.

Date.	Markets.	Wheat.		Barley.		Oats.		Rye.		Peas.		Beans.	
1845. Dec.	Dantzig.	30 6 to	35	[illegible] to	[illegible]	[illegible] to	[illegible]	25 6 to	35	35 6 to	42	32 to	33
1846. Jan.	..	45	36	25 6	25	22 6	26	34	37	36	44	32	33 6
1845. Dec.	Hamburg.	46	35	24 6	28	16	22 6	28 6	32	32 6	39	30	32
1846. Jan.	..	42	33 6	23 6	25 6	[illegible]	20 6	30 6	37	30	38	30	35
1845. Dec.	Bremen.	44	52	[illegible]	28	14 6	20	28	33	30 6	35	30	34
1846. Jan.	..	43	52	24	22	14	18	25	28	30 6	36	32 6	35
1845. Dec.	Konigsberg.	50	56	24	28	15	22	22	37	36	42	38	41 6
1846. Jan.	..	45	54	22	27 6	15	20 6	30	36 7	35	44 6	34	39 6

TABLE OF PRICES, &c.

Average Prices of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets :—

LONDON.

	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
6.	63 2	35 4	26 8	35 9	43 7	41 11
13.	66 0	33 7	26 0	36 8	44 6	39 3
20.	64 4	34 0	25 4	36 4	43 9	38 8
27.	61 4	33 6	25 4	36 3	43 6	38 1
3.	58 8	32 5	23 1	35 6	43 0	37 10
10.	61 7	31 9	23 1	34 6	43 5	36 3
17.	63 4	32 10	23 9	38 0	42 4	37 2
24.	62 11	32 11	23 10	38 2	39 10	36 8
31.	61 5	33 3	23 8	37 0	39 9	35 9

EDINBURGH.

Date.	Wheat	Barley.	Oats.	Pease.	Beans.
1845.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 3.	60 6	35 1	28 1	43 0	43 8
10.	54 5	33 5	25 7	45 0	45 4
17.	53 0	32 2	25 0	42 4	42 10
24.	56 2	33 0	25 9	42 2	42 9
31.	54 7	33 4	26 7	41 8	42 4
1846.					
Jan. 7.	53 6	33 1	28 2	39 0	39 7
14.	53 7	33 4	26 10	39 2	40 9
21.	53 6	31 6	26 1	39 0	39 10
28.	52 6	30 6	25 1	37 6	38 2

LIVERPOOL.

	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
6.	58 5	34 3	27 3	35 8	42 6	48 5
13.	58 4	34 7	28 4	35 2	43 6	45 0
20.	56 11	36 1	27 7	36 4	42 0	49 11
27.	54 1	34 2	26 11	36 6	39 1	43 3
3.	54 6	32 9	21 3	33 5	39 5	42 4
10.	55 7	35 0	26 0	34 8	35 11	43 1
17.	55 2	32 9	25 6	31 1	42 8	40 0
24.	55 3	32 8	26 7	31 3	39 8	40 11
31.	53 3	32 3	24 8	32 3	39 3	42 2

DUBLIN.

Date.	Wheat per Barrel 20 St.	Barley per Barrel 16 St.	Bear per Barrel 17 St.	Oats per Barrel 14 St.	Flour per Barrel 9 St.
1845.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 2.	34 2	17 6	16 4	16 0	18 10
9.	33 9	17 4	16 0	15 9	18 6
16.	32 6	16 9	15 9	15 4	17 10
23.	32 2	16 6	15 6	15 0	17 6
30.	31 7	16 0	15 0	14 6	16 6
1846.					
Jan. 6.	31 8	16 5	15 4	14 6	16 3
13.	30 8	15 5	15 6	13 9	15 3
20.	29 2	15 3	14 0	13 5	14 10
27.	28 11	14 4	13 8	13 4	13 7

LE shewing the Weekly Average Prices of GRAIN, made up in terms of 7th and 8th Geo. IV., 58, and 5th Vict., c. 14, and the Aggregate Averages which regulate the Duties payable on OREIGN CORN: the Duties payable thereon, from December 1845 to February 1846.

Wheat. Weekly Average.	Wheat. Aggregate Average.	Wheat. Duty.	Barley. Weekly Average.	Barley. Aggregate Average.	Barley. Duty.	Oats. Weekly Average.	Oats. Aggregate Average.	Oats. Duty.	Rye. Weekly Average.	Rye. Aggregate Average.	Rye. Duty.	Pease. Weekly Average.	Pease. Aggregate Average.	Pease. Duty.	Beans. Weekly Average.	Beans. Aggregate Average.	Beans. Duty.
s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
59 0	58 10	14 0	32 10	34 1	4 0	24 7	25 5	3 0	35 6	35 9	7 6	41 8	43 7	1 0	47 4	44 9	1 0
59 4	59 9	14 0	32 9	33 10	5 0	24 6	25 2	3 0	36 4	36 4	6 6	43 6	44 9	1 0	40 8	42 10	1 0
57 11	58 8	14 0	32 7	33 6	5 0	23 4	24 10	4 0	34 5	34 1	6 6	42 5	44 4	1 0	39 0	41 11	1 0
56 4	57 6	15 0	32 5	33 0	5 0	23 0	24 4	4 0	34 6	35 2	7 6	39 10	43 4	1 0	38 6	40 11	2 6
55 1	57 4	15 0	31 11	32 7	6 0	22 3	23 9	5 0	33 6	34 7	8 6	39 1	42 4	1 0	37 9	40 0	2 6
56 3	57 2	15 0	31 10	32 5	6 0	21 9	23 3	5 0	33 11	34 4	8 6	38 11	41 2	1 6	36 8	39 1	3 6
56 2	56 8	16 0	31 11	32 3	6 0	22 9	22 10	6 0	34 9	34 4	8 6	39 3	40 6	2 6	38 9	39 4	4 6
55 7	56 1	16 0	31 8	32 1	6 0	21 10	22 5	6 0	37 8	34 6	8 6	36 8	39 4	3 6	36 1	37 6	5 6
54 8	55 6	17 0	31 3	31 10	7 0	21 9	22 2	6 0	32 0	34 1	8 6	35 8	38 3	4 6	35 6	36 10	6 6

presented at market with coarse from the same crop. The natural consequence was, that a high price for the fine and a very low one for the coarse were placed in juxta-position; and as the coarse greatly preponderated in quantity, its price held the averages down, while it kept the duty high, when, in fact, good wheat was really wanted for mixing with the bad. This was the trying occasion for the graduated scale, and indeed it was an occasion in which no sort of scale could possibly be made to conform itself to it. In every other respect, the present law has operated well, having put down the nefarious working of the averages, and at the same time afforded a larger protection for a longer time than any former law ever did. In short, it was doubtless its pertinacity in affording ample protection under all circumstances that was the true cause of its condemnation by its own proposers.

THE REVENUE.

ABSTRACT of the Nett Produce of the Revenue of Great Britain, in the Quarters and Years ended on the 5th of Jan. 1845 and 5th of Jan. 1846—shewing the Increase and Decrease on each head thereof.

	Quarters ending Jan. 5.		Increase.	Decrease.	Years ending Jan. 5.		Increase.	Decrease.
	1845.	1846.			1845.	1846.		
	L.	L.	L.	L.	L.	L	L.	L.
Customs, ...	4,902,135	4,354,789	. .	547,346	20,378,672	18,105,206	. .	2,273,466
Excise, ...	3,230,940	3,338,837	107,897	. .	12,160,111	12,177,112	17,001	. .
Stamps, ...	1,601,058	1,792,102	190,714	. .	6,611,390	7,152,114	540,724	. .
Taxes, ...	1,880,490	1,876,051	. .	4,439	4,216,488	4,223,842	7,354	. .
Post-Office, . .	146,000	189,000	43,000	. .	675,000	731,000	56,000	. .
Miscellaneous, .	59,190	394,471	335,281	. .	848,630	1,383,241	534,611	. .
Property Tax, .	487,541	356,985	. .	160,556	5,191,596	5,026,570	. .	165,026
	12,307,354	12,323,236	676,922	652,341	50,081,887	48,798,685	1,155,690	2,438,492
			652,341					1,155,690
	Increase on the Qr.		24,581		Decrease on the Year,			1,282,802

FOREIGN MARKETS, per Imperial Quarter, free on Board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans
1845. Dec.	Danzig.	50/6 to 58/	20/ to 26/	14/ to 17/6	25/6 to 28/	38/6 to 42/	32/ to 38/
1846. Jan.	..	48/ 56/	18/6 25/	12/6 16/	24/ 27/	36/ 40/	30/ 36/6
1845. Dc.	Hamburg.	46/ 55/	20/6 28/	16/ 22/6	28/6 32/	32/6 38/	30/ 37/
1846. Jan.	..	42/ 53/6	18/6 25/6	15/ 20/6	26/6 30/	30/ 36/	30/ 35/
1845. Dec	Bremen.	44/ 52/	16/6 24/	14/6 20/	26/ 29/	30/6 35/	30/ 34/
1846. Jan.	..	42/ 50/	16/ 22/	14/ 18/	25/ 28/	30/6 36/	31/6 35/
1845. Dec.	Konigsburg.	50/ 56/	24/ 29/	16/ 22/	32/ 36/	36/ 42/	36/ 41/6
1846. Jan.	..	48/ 54/	22/ 26/6	15/ 20/6	30/ 34/6	35/ 40/6	34/ 39/6

TABLE OF PRICES, &c.

The Average Prices of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets:—

LONDON.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1845.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 6.	61 2	35 4	26 8	35 9	43 7	41 11
13.	66 0	33 7	26 0	36 8	44 6	39 3
20.	64 4	34 0	25 4	36 4	43 9	38 8
27.	61 4	33 6	25 4	30 3	43 6	38 1
1846.						
Jan. 3.	58 8	32 5	23 1	35 8	43 0	37 10
10.	61 7	31 9	23 1	34 6	43 5	36 3
17.	63 4	32 10	23 9	38 0	42 4	37 2
24.	62 11	32 11	23 10	38 2	39 10	36 8
31.	61 5	33 3	23 8	37 0	39 9	35 9

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1845.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 3.	60 6	35 1	28 1	43 0	43 8
10.	54 5	33 5	25 7	45 0	45 4
17.	53 0	32 2	25 0	42 4	42 10
24.	56 2	33 0	25 9	42 2	42 9
31.	54 7	33 4	26 7	41 8	42 4
1846.					
Jan. 7.	53 6	33 1	28 2	30 0	39 7
14.	53 7	33 4	28 10	30 2	40 9
21.	53 6	31 6	26 1	39 0	39 10
28.	54 8	30 6	25 1	37 6	38 2

LIVERPOOL.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1845.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 6.	58 5	34 3	27 3	35 8	42 6	48 5
13.	58 4	34 7	28 4	39 2	43 6	45 0
20.	56 11	36 1	27 7	36 4	42 0	49 11
27.	54 1	34 2	26 11	36 6	39 1	43 3
1846.						
Jan. 3.	54 6	32 9	21 3	33 5	39 5	42 4
10.	55 7	35 9	26 0	34 8	35 11	41 1
17.	55 2	32 9	25 6	33 1	42 8	40 0
24.	53 3	32 8	25 7	33 3	39 8	40 11
31.	53 3	32 3	24 8	32 3	39 3	42 2

DUBLIN.

Date.	Wheat per Barrel 20 st.	Barley per Barrel 16 st.	Bear per Barrel 17 st.	Oats per Barrel 14 st.	Flour per Barrel 9 st.
1845.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 2.	34 2	17 0	16 4	16 0	18 10
9.	33 9	17 4	16 0	15 9	18 6
16.	32 6	16 9	15 9	15 4	17 10
23.	32 9	16 6	15 6	15 0	17 6
30.	31 7	16 0	15 0	14 6	16 6
1846.					
Jan. 6.	31 8	16 5	15 4	14 6	16 3
13.	30 8	15 5	15 6	13 9	15 3
20.	29 2	15 3	14 0	13 5	14 10
27.	28 11	14 4	13 8	13 4	13 7

TABLE shewing the Weekly Average Prices of GRAIN, made up in terms of 7th and 8th Geo. IV., c. 58, and 5th Vict., c. 14, and the Aggregate Averages which regulate the Duties payable on FOREIGN CORN: the Duties payable thereon, from December 1845 to February 1846.

Date.	Wheat.			Barley.			Oats.		
	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.
1845.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 6.	59 0	58 10	14 0	32 10	34 1	4 0	24 7	25 5	3 0
13.	59 4	58 9	14 0	32 9	33 10	5 0	24 6	25 2	3 0
20.	57 11	58 8	14 0	32 7	33 6	5 0	23 4	24 10	4 0
27.	56 4	57 6	15 0	32 5	33 0	5 0	23 0	24 4	4 0
1846.									
Jan. 3.	55 1	57 4	15 0	31 11	32 7	6 0	22 9	27 9	5 0
10.	56 3	57 2	15 0	31 10	32 5	6 0	21 9	23 9	5 0
17.	56 2	56 9	16 0	31 11	32 3	6 0	22 8	22 10	6 0
24.	55 7	56 1	16 0	31 8	32 1	6 0	21 10	23 5	6 0
31.	54 6	55 6	17 0	31 3	31 10	7 0	21 9	22 2	6 0

Date.	Rye.			Pease.			Beans.		
	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.	Weekly Average.	Aggregate Average.	Duty.
1845.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 6.	35 6	35 9	7 6	41 8	43 7	1 0	43 4	44 9	1 0
13.	36 4	36 4	6 6	43 6	44 9	1 0	40 8	42 10	1 0
20.	34 5	34 1	6 6	42 5	44 4	1 0	39 0	41 11	1 0
27.	32 8	35 9	7 6	39 10	43 4	1 0	38 6	40 11	2 6
1846.									
Jan. 3.	33 6	34 7	9 6	39 1	42 4	1 0	37 9	40 0	2 6
10.	33 11	34 4	8 6	38 11	41 2	1 6	36 8	39 1	3 6
17.	34 9	34 4	8 6	39 3	40 6	2 6	36 0	38 4	4 6
24.	37 8	34 6	8 6	36 8	39 4	3 6	36 1	37 6	5 6
31.	32 0	34 1	8 6	35 8	38 3	4 6	35 6	36 10	6 6

The MONTHLY RETURNS, published in terms of 9th Geo. IV., c. 60, shewing the Quan'i Corn, Grain, Meal, and Flour imported into the United Kingdom in each Month; the Qua upon which duties have been paid for home-consumption, during the same Month; and the tities remaining in Warehouse at the close thereof, from 5th December 1845 to 5th February 18

Month ending	IMPORTED.			CHARGED WITH DUTY.			REMAINING IN WAREHOU		
	From Foreign Countries.	From British Possessions.	Total.	From Foreign Countries.	From British Possessions.	Total.	From Foreign Countries.	From British Possessions.	T
Dec. 5, 1845.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qr
Wheat, .	142,842 4	10,400 3	153,242 7	7,220 4	10,424 6	17,645 2	794,201 6	51 2	794,
Barley, .	20,834 6	. .	20,834 6	9,886 6	45 4	9,932 2	67,574 2	. .	67,
Oats, . .	57,575 2	27 5	57,602 7	54,262 3	27 5	54,290 0	108,596 0	. .	108,
Rye, . . .	129 4	. .	129 4	. .	. .	. .	129 4	. .	
Pease, .	13,044 3	521 3	13,565 6	14,058 1	521 3	14,579 4	950 4	. .	
Beans, .	27,722 2	. .	27,722 2	28,062 3	. .	28,062 3	803 4	. .	
Totals,	262,148 5	10,949 3	273,098 0	113,490 1	11,019 2	124,509 3	972,255 4	51 2	972,3
Jan. 5, 1846.									
Wheat, .	160,909 6	12,415 4	173,325 2	8,097 2	9,022 4	17,119 6	944,548 4	3,444 6	947,9
Barley, .	34,590 3	. .	34,590 3	54,071 6	. .	54,071 6	45,803 6	. .	45,8
Oats, . .	48,397 6	. .	48,397 6	111,702 4	. .	111,702 4	45,776 3	. .	45,7
Rye, . .	. .	. .	. .	. .	. .	. .	129 4	. .	1
Pease, . .	18,555 4	3,574 6	22,130 2	18,959 4	3,339 2	22,298 6	1,022 6	236 4	1,9
Beans, . .	23,546 2	. .	23,546 2	23,626 6	. .	23,626 6	819 4	. .	8
Totals,	285,999 5	15,990 2	301,989 7	216,457 6	12,361 6	228,819 4	1038,100 3	3,681 2	1,040,7
Dec. 5, 1846.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt.
Flour, . .	114,677 1 9	133,824 3 5	248,492 0 14	820 2 16	118,881 2 21	119,702 1 9	372,063 3 9	33,394 3 9	405,15
Oatmeal,	1 2 16	9 2 8	11 0 24	1 2 4	9 2 8	11 0 12	160 2 10	2 2 16	16
Totals,	114,678 3 25	133,834 1 13	248,803 1 10	822 0 20	118,891 1 1	119,713 1 21	372,224 1 19	33,397 1 25	405,62
Jan. 5, 1846.									
Flour, . .	82,009 1 16	70,447 3 5	152,457 0 21	2,177 2 14	46,667 3 8	48,845 1 22	451,464 3 9	57,168 2 12	508,63
Oatmeal,	10 2 8	238 2 16	249 0 24	10 2 20	228 3 4	239 1 24	160 2 10	2 3 16	10
Totals,	92,019 3 24	70,686 1 2	152,706 1 17	2,188 1 4	46,896 2 12	49,084 3 18	451,625 1 19	57,171 2 0	508,79

PRICES of BUTCHER-MEAT.

Date.	LONDON, Per Stone of 14 lb.		LIVERPOOL, Per Stone of 14 lb.		MORPETH, Per Stone of 14 lb.		EDINBURGH, Per Stone of 14 lb.		GLASGOW, Per Stone of 14 l	
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mut
1845. Dec.	6/9 to 8/	6/6 to 8/3	6/3 to 8/3	6/6 to 8/3	6/3 to 8/	6/ to 7/9	6/3 to 7/6	5/9 to 7/6	6/ to 8/	6/ to
1846. Jan.	7/3 8/3	7/3 8/6	6/9 8/6	7/6 8/6	7/3 8/3	6/9 8/	6/6 7/9	6/ 7/9	6/6 8/3	6/6

PRICES of English and Scotch WOOL.

ENGLISH, per 14 lb.		
Merin	./6 to 20/	
[illegible]	2/6	16/6
South Down,	6/	21/
Half Bred,	3/	16/6
Leicester Hogg,	5/	20/6
Ewe and Hogg,	2/	6/
Locks,	7/	0/
Moor	[illegible]	[illegible]

SCOTCH, per 14 lb.		
Leicester Hogg, . . .	15/	to 20/6
Ewe and Hogg, . . .	11/	14/6
Cheviot, white, . . .	10/	14/
Laid, washed, . . .	7/9	11/
unwashed, . . .	6/6	9/
Moor, white, . . .	6/	7/6
Laid, washed, . . .	4/	6/3
unwashed, . . .	3/3	5/3

ON RECLAIMING HEATH LANDS.

By Mr Thomas Rowlandson, Liverpool.

One of the subjects submitted by the R. E. Agricultural Society for the year 1845, as a subject for prize essays, was the above. On that occasion I forwarded the following article on the subject; the prize, however, was awarded to Mr Watson of Kendal. It is not my intention to dispute the correctness of the decision, as the doing so would in a great measure be a criticism on my own production, as on a great variety of matters pertaining to the subject, Mr Watson and I perfectly agree, and, singularly enough, so completely so in some cases, that, substituting mustard for oats, our illustrations might have been drawn from the same operation. Mr Watson, however, appears to have drawn his observations on the subject from the practice pursued in the mountainous part of the north of England, and which he appears to recommend as the best course. This I am, however, by no means willing to admit. We both agree as to the necessity for paring, burning, and liming. Mr Watson, however, states that the push-plough, called flaughter-spade in Scotland, is the best adapted for the purpose: if he can get it done for the sum stated in his essay, (10s. an acre,) I am willing to admit the truth of the observation. He alludes also to paring with a light paring-plough drawn by one horse. I have had some experience in using horses for this purpose, but I never found one horse able to do any thing, and two were often knocked up, the work being much harder than ploughing a stiff old ley. Paring by the push-plough cannot, however, be extensively carried into operation; because, in the first place, heaths are thinly populated, and accommodation is not to be found in their vicinity for a great number of labourers, even though such could be brought in sufficient numbers from a distance. The thing may be used, and, in fact, is the best mode of proceeding at the above price, for a 10 or 20 acre patch; but where three, four, or five hundred acres are to be reclaimed, this mode will be found wholly inadequate. The common Dutch paring-plough is the best adapted for the purpose where a large tract is to be reclaimed; and I should recommend that the ploughing and cross-cutting should be performed the summer or autumn of the year previous to the operation of burning. The sods, by lying in a rough state, and being subjected to the frost of the winter preceding, thus become tender and friable; and if a large triangular harrow or scarifier, with teeth about a foot in length, be drawn once or twice through the sods during the first dry weather in spring, the same

will be prepared for heaping up with a "*bob*," as alluded to in the following essay. Where the nature of the surface of the soil will permit, viz. free from stones, hassocks, heath, &c., a wheel coulter or scarifier, as it is sometimes called, should be used to the plough. The mode employed for reclaiming heath land in Cumberland, with which I am perfectly acquainted, and which is the only mode recommended by Mr Watson, is only adapted for individual cases, and those merely on a small scale, but certainly not such as ought to be adopted by either improving tenants or landowners. The plough, the scarifier, and the "*bob*," are the implements a skilful and intelligent farmer will always adopt for such operations. I have not entered into an account of the expense of the various operations, as to do so would be perfectly illusory, as the same cannot be adapted for lands so variously situated as heaths are, with respect to both labour and lime, and also the physical condition of the land as regards draining, quantity of stones required to be removed, &c. To sum up, it may be stated, that all these must be taken into consideration by the intending improver, and his calculations must be based upon the prices which ordinarily rule in his particular neighbourhood.

I have perceived, from the various accounts of the reclamation of waste lands, as given in the Transactions of the Highland and Agricultural Society, that in no instance has an account been given where paring (by the plough) and burning, and then subsequent liming, have been adopted. If the three operations have been performed, the first (paring) has been performed by the spade, or the lime has been omitted; in other cases the burning has been omitted. It cannot, however, be too much impressed upon the improver of heaths, that for an extensive operation the use of the implements before described, together with *burning and liming*, are essentially necessary to the permanent improvement, and also to its economical achievement. With respect to liming, the principles set forth in the following essay are a mere recapitulation of the main features of previous papers on the subject of lime which have already appeared in this Journal. A word of advice, however, may not be amiss here—viz. that on trap rocks covered by a soil formed by its own decomposition, lime is rarely needed, and, if at all, only in very small quantity, unless it be on black peaty matter formed by the overflowing of a spring. This is a matter of importance, as it generally happens that the trap, greywacke, and slate formations, from their extended surface, are found the most distant from lime, as well as being further inconvenienced by mountainous and bad roads. Mr Watson states that for some heath lands, viz. "the lighter description of bog earths, he makes an exception to the use of quicklime, which only tends to accelerate its too rapid

decomposition, and to give it additional lightness." He further states, "quicklime is too powerful and barmy in its effects on such lands;" and recommends milder lime or marl. Now, the chemical effect of an application of lime or marl is precisely the reverse; and I hope no reader of this Journal will be ever induced to use, on peaty soils of *any* description, lime in any other form than that of quicklime, if it can be procured. With these preliminary remarks, I leave the reader to form his own opinion of the merits or demerits of the following paper.

Heath land is a term of a vague description, as such lands are to be found consisting of soils totally different to others, and of the greatest variation with respect to altitude. They may, however, be divided into three great divisions, viz.—1st, Hills covered with heath, furze, fern, broom, juniper, &c., where resort the plover, lapwing, grouse, blackcock, fox, &c.—the only domestic animals capable of sustaining themselves on these dreary wastes being the goat, the hardy blackfaced sheep, the small Welsh mountain and an analogous Irish sheep.* On the lower and more fertile parts of such hills, which are generally the most free from heather, may be found browsing in addition, (according to their respective districts,) either the small Welsh black cattle, or the hardy Scot. I may here incidentally remark, that the true Kerry is admirably adapted, from its being a hardy feeder, and possessed of several excellent qualities, to graze on such places, and is deserving of more attention from persons possessed of lands of this description.

The colour of the soil of such lands is generally an ochreous yellow, sometimes approaching to a brown, and not unfrequently possessing the appearance and qualities of a fine hazel loam, and would doubtless form a first-rate arable soil, were its depth sufficient and equable. The obstacle to improving the same for arable cultivation principally arises from the circumstance, that there always exists, mixed up with the surface-soil of such heath lands, enormous quantities of large and small stones, and numerous projecting portions of rock, which offer at every step an almost insurmountable impediment to the progress of the plough. The heaths just described are, generally speaking, comparatively dry, the rain-water being mostly carried away through the fissures in

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* Not being acquainted with the Exmoor sheep, I cannot say whether their characteristics are similar to the two last named or not, but from the description I have heard of them, I presume they are much like those above described; and also that their pastures on that celebrated moor are of a mixed description, similar to the first and second described "Heath Lands."

the rocks, which generally approach close to, and sometimes appear above, the surface.* The principal exceptions arise from the following circumstances—viz., when a spring gushes forth from the side of such hills, and spreads itself in various directions, filling up small hollows with water, which give rise to the growth of mosses and various aquatic plants, whose decay eventually forms small patches of peat—the borders and vicinity of rills flowing from such springs being at the same time occupied by the various tribes of junci, carex, &c. Heaths of the preceding description rarely or ever possess a subsoil of what is commonly termed till and moorband. 2d, What may be termed moorland and wolds, containing a mixture of gravel and peat, stonebrash sand and peat, &c., and frequently infested with a great quantity of large boulders projecting above, lying even with, or close to the surface: such soils are generally found on moderate slopes, incumbent generally on a hard till or moorband pan. Often the subsoil is a stiff unfertile white or blue clay, the former generally mixed with a considerable quantity of silicious matter in the state of a quartzoze paste. The surface or available soil on such heaths generally runs from four to twelve inches in thickness—rarely exceeding the latter depth except in hollows. Heath of this nature is easily distinguished by the most superficial observer from the first described, by the following appearances, viz., the heather being neither so tall nor luxuriant, and interspersed at much wider intervals; the furze partakes of the same dwarfish nature; the total absence of fern, which, in the better sort of the first described class of heath, is usually abundant,—the absence of fern proving, by negation, the undue presence of moisture, and a sparing amount of available potash. In the place of fern, we however discover the dwarf sallow, and the bilberry. The appearances just described are sufficient to attract the attention of the most casual and uninformed observer, to the marked difference between the characteristics of the soil composing this and the first described heath, without having recourse to examining the same by the spade. In the consideration of the cultivation of heath lands, I include amongst this class deep bogs of every description, whether situate on mountain-sides or hollows. In England, we do not find any considerable quantity of deep bog lands on mountain-sides. In Scotland they are more frequent; but in Ireland and Wales they are exceedingly common, and offer to the enterprising cultivator an almost boundless field for profitable investment. Deep bogs of the description alluded to are often completely

* Heaths may be known to be dry wherever the fern is found—irrigation, or the presence of water in any shape, being found utterly destructive to this plant. I may also state, that the fern is a sure indication of the presence of decomposed potash minerals, and, I may almost add, consequently fertile soil.

covered with a compact growth of low scrubby heather, and may, therefore, be properly taken into consideration in this essay.

In regard to the grasses grown on the two classes of heaths just described, there will generally be found a material difference. On the first will be discovered, amongst various species of agrostis, the sheep and sometimes the Welsh fescue, (holcus lanatus,) or woolly soft grass, and poa annua, and occasionally the white clover. On the last described, not a blade of the true grasses (except a few of the inferior species of agrostis) will be found, the rest of the herbage consisting of the carices, junci, &c. The only purpose of pasture to which the last described heath can be applied, is the pasturage of young stock. The mountain cotter's cow also contrives, during summer, to obtain sufficient food to enable her to yield a scanty supply of milk to her humble owner's family.

3d, The last class of heaths consist of unfertile sands, containing very little vegetable matter, the inorganic constituents of the soil being almost entirely composed of sand, (silicic acid,) bound together by the roots of the coarse grasses and weeds which grow on the surface of such soils; the herbage on these heaths is always of a stunted and inferior description, being composed of dwarf, inferior, and innutritious grasses, often plentifully intermixed with the weeds peculiar to sands.* The colour of such soils is usually from a pale brown to a deep black, according to the quantity of decayed vegetable matter (humic acid generally) existing therein, amongst which a few bright grains of glistening sand may be distinguished. If any furze or heather should exist, it will be of the most scrubby description, and the whole appearance presents to the most ignorant (agriculturally) spectator the most desolate appearance imaginable; and, under all circumstances, offers to the husbandman the field least likely to remunerate him for his labour and skill. Chalk downs may be classed with this description of soil, but the latter will not be so ungrateful to the farmer for his care and attention. I shall dismiss all mention of waste clay lands on the following account, viz. that if capable of draining, that is the panacea; if incapable, the task of improvement is hopeless: besides, no considerable tract of land is to be found of this description in the state of heath.

Having thus given a brief, but I hope tolerably clear description of the most important groups into which heath lands may be divided, I shall at once enter into the investigation of the modes best adapted for rendering the same most profitable to the farmer and owner. With respect to the first division which I have no-

* When much free humic acid is present, great quantities of the rumex acetosella (sheep-sorrel) will be found.

ticed, in justice I ought to state that my experience is not founded upon practice instituted for the purpose of benefiting myself or others with whom I was in immediate connexion, but rather from observation of the practice of my neighbours who had entered into operations with the intention of rendering such lands more valuable. As, however, undertakings of this kind were frequently made in the immediate vicinity of my residence, and by parties with whom I constantly associated, it is but fair to suppose that I became as intimate with the details of management, and practically acquainted with the costs of the processes used, as though they had been under my direct control. My earliest observations on the subject were made towards the conclusion of, and the two or three years succeeding, the last war; when, in consequence of the high price of all descriptions of agricultural produce, so great a stimulus was given to every branch of agricultural operations. At the period alluded to I resided at the most northern confines of the county of Lancaster, in the district commonly termed "Furness Fells," and immediately adjacent to the counties of Westmoreland and Cumberland, better known, however, to the tourist under the denomination of "The Lakes." In this, like all mountainous regions, the character of the soil is extremely diversified, from the fertile Vale of the Kent to the inhospitable wastes of Borrowdale. The principal, I might almost state sole, dependence of the farmers of the district for the payment of rent and other outgoings, arises from the produce of the wool derived from the large flocks of sheep which are kept on the mountain pastures during summer, and the occasional sale of the increased number of their flocks. The corn raised principally consists of oats,* the whole of which is consumed in the district. Small patches of wheat are sometimes grown in the most fertile parts of the vales, and a little barley. The sheep are fetched from the mountains twice a-year, viz. in the month of May, in order to be shorn, and about the commencement of November, at which latter period they remain permanently in the valleys until the genial warmth of spring returns, when they are again sent to the mountains. It is immediately after their return from the mountains at the last named period that the sheep undergo the operation of smearing, locally termed salving,—viz. depositing at the roots of the wool an ointment formed of tar and any common cheap fat. I believe the above sketch, both as regards the character of the

* The bread used amongst the farmers entirely consists of oatmeal baked into exceedingly thin cakes, locally called "havre bread." Oatmeal porridge with skimmed milk is the usual morning and evening meal. The mode of farming and living is similar to that pursued in extensive Highland districts in Scotland, with the exception that in the latter country large quantities of cattle are [illegible]

heath lands, and the mode of farming pursued in the district, will apply to the whole of the heath lands of the north of England, and the greater part of those situate in Scotland; except that, in addition to sheep, a great number of black cattle are raised on the heaths of the latter country. In the concluding observations of this paper, I intend to show that it is almost impossible to witness much improvement in the heath lands of a mountainous country like that described, unless an equal advance is made in the system of husbandry pursued in the fertile lands of the vales. At present, however, I shall confine my remarks to the best method of improving the soil of such heaths, whether for permanent pasture or occasional arable cultivation.

It must be perfectly apparent to all, that the heath lands now under consideration cannot under any circumstances be converted into soils even of second-rate value. The question of their further improvement, therefore, necessarily depending upon the costs attendant thereon, it becomes consequently a matter of primary importance that we avail ourselves of all the natural advantages which such heaths possess, by being placed on declivities. It is extremely rare that we find mountains destitute of springs, which by their frequently flowing over an extended space, give rise (as has been previously observed) to the growth of plants belonging to the tribes of junci and carex. It is obvious, therefore, that if we artificially cut proper drains, for the purpose of carrying off the spring water, we shall prevent the growth of the plants just named. In most cases, drains of a foot in breadth, and a similar depth, will suffice for the purpose. Having thus prevented the springs which may arise from doing further, or continuing the injury sustained by an excess of moisture, a question arises, whether we cannot convert the water now flowing to waste into an important agent for furthering our intended improvements, not only by aiding us in our preliminary steps, but also as a valuable assistant in maintaining and fertilizing such soils, after the more arduous and expensive process of breaking up has been performed. This can easily be performed by catch-work irrigation.* It has been previously remarked, that the presence of fern is a certain indication of a dry soil; its luxuriance is the certain mark of a fertile one. No plant delights more in a dry rich soil than the fern, and few are more susceptible of the presence of water. If we, therefore, judiciously apply the water issuing from springs on mountain sides to a species of catch-work irrigation, we shall most certainly extirpate, in the course of about three years,

* The nature of the land would totally prevent any other description of irrigation.

the whole of the ferns subjected to its influenee;* whilst, *at the* same time, if the irrigation is properly managed, in its place a much superior growth of grasses will arise to that which was exhibited whilst necessitated to grow under their shade. Furze and heath will also eventually give way, by the continued action of irrigation. With the two last-named shrubs, however, it is much better that the ordinary course of temporarily getting rid of the same be adopted, (viz. by burning,) previous to the application of irrigation. The burning of heath is a very common process, usually performed by setting fire to the same, in the direction of the wind, at some dry period of autumn. Large masses of heather are thus frequently temporarily got rid of, leaving only on the mountain sides a quantity of blackened stumps; and, in the course of the following spring, a tolerably thick growth of grass springs up, which continues a few years, until again overshadowed by fresh shoots of heath, which are produced from the former undestroyed roots.

I cannot, perhaps, in any place, introduce more appropriately the manner in which lime acts beneficially on heath (and I may add other) lands, than in the present place. I shall, at the risk of being challenged with prolixity, enter into the question at some length. To do so, however, and at the same time give a clear explanation of its precise and chemical action, would be impossible, unless I also take into consideration the action of humic acid, or, as the continental chemists term it, *humus*. I shall, at the same time, briefly glance at some of the opinions formerly entertained on the subject, but which, I trust, I shall most clearly show were totally incorrect. One of the most prominent errors, and the most extensively diffused opinion respecting the action of lime is, that it converts insoluble vegetable matter in soils into soluble food for plants. Our illustrious countryman Davy was the first who promulgated this error. Being engaged in Ireland, a few years ago, in reclaiming some bog land, and what is provincially called "mountain"—*i. e.* land similar to the description previously given in the second class—I was induced to direct my attention to the action of lime upon all descriptions of soils. I was the more incited to make the most marked observations respecting the operation of lime in fertilizing such soils, as the liming cost double the amount of all the other preparations for a crop, including seed, (with the exception of the potato crop.) Having just noticed the prevailing opinion respecting the beneficial action of lime in converting insoluble organic matter into soluble food for plants, it may not be amiss at the same time, to allude to the manner in which it has

* For additional particulars on this subject, see the excellent Prize Essay by Mr [illegible] in the 11th volume of the Highland Transactions, 1835—1837, p. 371.

been heretofore supposed that it acts beneficially towards vegetation, by the decomposition of substances in the soil which are either known or supposed to be noxious to vegetation. The substances alluded to are generally considered to consist of the sulphate of iron and free tannic or gallic acid. It is chemically impossible that the sulphate of iron and the tannic acid can at one and the same time be present in any soil. The sulphate of iron would be immedately converted into the tanno-gallate of iron, (common writing-ink.) From this fact, we can easily test whether either of the substances named separately exist in any soil; for, if we suspect the presence of sulphate of iron, by pouring a little of the infusion of galls into water which had previously been macerated with the suspected soil, a black colour would immediately be perceived, the intensity of which would be in the precise ratio of the quantity of the sulphate of iron present. The converse of the operation will serve to show the quantity of tannic or gallic acid present. Now, I have examined both fertile and unfertile soils of every description, gathered in England, Scotland, Ireland, and Wales, and in various modes have tested the presence of the sulphate of iron and the tannic acid, but in no instance did I discover a trace of the former,* and, except in the vicinity of a chalybeate spring, on no occasion have I found the latter. With respect to the tannic acid, I am quite certain no such thing exists in any soil; and the reason that this acid has been heretofore supposed to exist in soils, arises from the appearance of a brown-coloured water in bogs and morasses, and the well-ascertained fact, that the water alluded to was highly antiseptic—bodies of men having been discovered in deep bogs in the most perfect state of preservation, whose garments, &c., have clearly proved that they must have been of the highest antiquity. The brown-coloured water alluded to is humic acid, combined with some alkaline base, mostly potash or ammonia. It is by no means improbable, in some cases, where iron pyrites (the sulphuret of iron) abound, that their decomposition may give rise to the formation of sulphate of iron, (green vitriol or copperas;) but as this often takes place, accompanied by the decomposition of felspathic minerals, it will easily be seen that the sulphate of iron will be decomposed, forming the sulphates of potash, soda, and sometimes lime, at the same time setting free the protoxide of iron, which, however, is immediately con-

* Since the above was written, I have been favoured by the perusal of several articles, by P. Garden, Esq., Glenæ House, in the *Dumfries Herald*, on various agricultural subjects. Amongst others, some relate to the formation of sulphuric acid by the decomposition of sulphurets during winter, in which it is most plausibly, if not actually, shown that sulphate of iron is formed in soils during winter.

verted into the peroxide—thus giving the red colour to a great variety of soils. It is probably on this account, that I have on no occasion discovered any traces of the sulphate of iron in soils. Sprengel, the celebrated chemist, however, contends that the sulphate of iron is beneficial in certain soils; but he states, that "in soils which contain much humus, or free humic acid, green vitriol, or a mineral containing it, *will be always hurtful*, as it will be decomposed by the humic acid; and both the humate of the protoxide of iron thus formed, and the sulphuric acid thus set free, will injure the plants—the former substance supplying them with too much iron, whilst the latter will corrode their roots." Now, I have endeavoured on several occasions to compose the humate of iron by the direct combination of free humic acid with the protoxide of iron or the sulphate of iron; but I only imperfectly, if at all, succeeded. When, however, a solution of the humate of potash or ammonia is formed into a solution of sulphate of iron, double decomposition immediately takes place; a dark-coloured precipitate, sometimes of a greenish hue, is deposited—viz. the *insoluble* humate of iron, the supernatant liquid holding in solution the sulphate of potash or ammonia, as the case may be. It is evident, therefore, that Sprengel's theory is entirely wrong, as the humate of iron, being *wholly insoluble*, can have no decided influence on the growth of plants; and as I find, by direct experiment, that no sensible decomposition takes place when merely sulphate of iron and humic acid are combined, we must *a priori* conclude, that no sulphuric acid to any amount can possibly be liberated, so as to become injurious to the roots of plants. As we find, however, that the sulphates of potash and ammonia are, when applied directly to soils, highly beneficial to the crops growing thereon, we are forced to arrive at the conclusion, that wherever such a double decomposition does take place as I have previously described, the same must be highly fertilizing to the soil in which it occurs. The preceding details are given, in order to show that lime does not owe its fertilizing properties to decomposing the tannic acid or the sulphate of iron, though doubtless, were the latter present in any remarkable quantity, lime, or other alcareous matter, would be the most fitting preliminary applica-ion; as the sulphate of iron would thus be decomposed, and the ulphate of lime (gypsum) be formed, and oxide of iron set free. he presence of a free salt of iron, such as the sulphate, is easily ted by macerating a small amount of the suspected soil, and ing the liquid when decanted by a few drops of the solution errocyanate of potash, (prussiate of potash,) when a blue-loured precipitate (prussian blue) will occur.*

* It is almost an invariable rule, that peats, whose ashes contain the greatest ount of [illegible] form the [illegible]chest of that description of soils when culti- [illegible] [illegible] small amount of white ash.

I think I have now given abundant reasons to presume that lime seldom, if ever, owes its quality as a fertilizer to either decomposing the tannic acid or sulphate of iron; I shall therefore proceed at once to show the precise manner in which lime exercises the properties of adding to the fertility of the soils to which it is applied. It will, however, be necessary, in order to perfectly explain the subject, to make a few brief remarks respecting the phenomena of the decay of vegetable matter (woody fibre) under certain circumstances.

The commonest observer must be struck, when his attention is drawn to the subject, by the remarkable difference between the decay of the vegetable matter which has grown on a rich dry loam and a peat morass. In the first, we observe a more luxuriant vegetation, and yielding a larger amount per acre of woody fibre, than that yielded on a barren peat bog; yet, notwithstanding, the soil of the one, at the expiration of a century or centuries, appears not to have obtained any perceptible increase of organic vegetable matter, whilst on a barren morass, under favourable circumstances, during a similar period, the thickness of decayed vegetable matter may have increased some feet. These facts can only be accounted for by the different modes in which vegetable matter is decomposed under the varied circumstances in which it is placed; in the one, we observe that the vegetable fibre, when it ceases to form a part of the living organism of plants, is freely (in consequence of a perfect drainage) exposed to the alternating action of water (arising from dews and rain) and the oxygen of the atmosphere; in the latter, except during great droughts, it is totally surrounded by water, and the decay may, in general, be stated to take place under water. The substances which are thus produced by the decay of woody fibre under the conditions named are totally different; the free access of moisture and oxygen, in the one, causing nearly the whole of the carbonaceous matter to be converted into carbonic acid gas; the small quantity of carbonaceous products which remain in the soil, constituting what is termed "mould;" mixed with varied quantities of sand, clay, lime, &c., form our most valuable arable and pasture soils. I must, in this place, beg to draw the reader's particular attention to the circumstance, that mould formed in this manner is invariably insoluble in alkalis.* In morasses, however, supersaturated with moisture, only a small portion of the carbon of decaying plants is converted into carbonic acid gas, in consequence of there not being sufficient oxygen present to convert the whole into carbonic acid gas, the remaining com-

* A small portion of humic acid, soluble in alkalis, may sometimes be found in soils, as described above, but only in minute quantity.

pound being humic acid—a substance insoluble in pure but soluble in the alkalis, soda, potash, ammonia, &c. which is precipitated from the same by lime and its sal the salts of iron, silver, lead, magnesia, and barytes. position can be proved in the most satisfactory manne to the meanest capacity, by the following simple expe Let two portions of soil be taken from heaths of di qualities; let the first be taken from a heath composed free, loamy, brown-coloured soil to which I have formerly a and, if possible, let it be taken from a spot where the fern in the most luxuriant manner; put a small portion of th so obtained into a tall ale, wine, or champagne glass, an over the same a small quantity of caustic ammonia, (hart diluted with twice or thrice its weight of water, or a weal tion of caustic soda or potash; let the same be well shake allowed to stand fifteen or twenty minutes. If the soil ha precisely of the description I have named, and containing if any, vegetable matter, no perceptible change in the colo take place, except perhaps a slight degree of redness fro presence of a small portion of the oxide of iron.* On th hand, let a sod be taken from a barren heath, composed pally of decayed vegetable matter—in other words, turf o When caustic ammonia, or solution of caustic potash, poured over a portion of the same in a glass, as before men the experimenter will perceive that the solution will imme assume a brown colour, which, in a short time, will be so d almost to appear black; this is humic acid combined wi alkali which may be used on the occasion. In my future re I will assume, for the sake of perspicuity, that ammonia ha employed; the humic acid thus held in combination wi ammonia can be precipitated by acids; and, by extremely filtration, can be obtained in a separate state. When thu cured, humic acid is a substance of a deep brown, almost colour. It is this slight solution of humic acid with the which gives that peculiar brown colour to bog water. compared bog water with the same tests as the solution of acid with ammonia, and the results are such as leave n slightest doubt as to their indentity. Liebig was the fir established the fact, that ammonia existed in rain water. this small portion of ammonia which descends with every

* Persons unused to the examination of soils may possibly procure, purpose of this experiment, soils which contain a portion of humic ac the contrast between the results of the experiments made with this kin and that from peat is so extraordinary as to strike any observer. The making the above experiment for the purpose of contrast, had better d soil from the most fertile field in the vicinity, the other from a bog.

of rain, which causes the water that stagnates in bogs to have so peculiar a colour. Humic acid is insoluble, except when recently formed; and then, according to Sprengel, only soluble in 2400 times its own weight of water. The humate of lime is perfectly insoluble. Having now shown how the humate of ammonia is to be obtained from peat, I shall proceed a step further. The experimenter must now decant or filter the supernatant brown-coloured fluid into another glass; at the same time, he must have ready a bottle of clear fresh-made lime water. Having now filled, say a champagne glass, about one-quarter full of the humate of ammonia, procured as above described, he may proceed to pour into the glass an equal quantity, or somewhat more, of lime water. If the glass is now allowed to stand a few minutes, it will be perceived that the liquid has assumed a turbid appearance, and afterwards separates into deep-coloured flakes, which are eventually precipitated. If we filter the same, we shall obtain a dark-coloured substance, with the following properties, viz.:—It is perfectly insoluble in alkalis, acids, and water; the only mode of decomposing the same is by fire, when, after the carbonaceous matter has been burned away, we shall have only one remaining substance, lime. This is a remarkable compound of lime, in consequence of its being unaffected by either the sulphuric or oxalic acids, all the salts of lime being decomposed by the latter acid. Having now found that the richest soils yield little or no humic acid to a solution of ammonia, whilst the barren peat yields humic acid freely; and further, that lime combines with humic acid and its compounds, forming a precipitate, (the humate of lime,) we must arrive at the conclusion, that lime acts beneficially on a great portion of barren lands, by neutralizing the free humic acid in the soil. If, however, any one is sceptical on the subject, let him obtain a small portion of finely powdered peat, say 16 ounces; also procure 2 ounces of unslacked lime: let him test the peat earth before he commences the experiment, whether it will discolour common hartshorn. When satisfied on this head, let him pour as much water on the quicklime as will form it into what is termed milk of lime; then mix the peat earth, and the lime, and the water, thoroughly together, and if needed, pour a little more water on the mass, so as to make it tolerably moist; if it is then left for two or three hours, and afterwards examined, it will be quickly discovered that the mixture has totally lost the property of giving a brown colour to liquor ammonia. The above are sufficient evidences that lime applied to heath lands acts beneficially *solely* by rendering humic acid insoluble in the presence of other alkalis, owing to its greater affinity to lime. I could, in addition to the above reasons, give several physiological ones, were it not that time will not permit me; and also, that it would

probably stretch this paper to too great a length. The results previously described, however, perfectly accord with the experiments of Mülder, Herman, and Wiegman and Polstorff. It is well known that a great variety of opinions exist as to the action of lime; the experiment previously described explains the whole. On heath lands containing only a small amount of humic acid, a less amount of lime will suffice; whilst on deep turburies almost any conceivable amount may be put. With the latter, however, I have practically found that a less amount than 100 bushels per acre is ineffectual; whilst on fine dry heaths, consisting principally of a hazel loam much mixed with stones, I have heard of so small a quantity as 20 bushels per acre producing the most marked effects. On stiff, wet, sour clays, (always containing free humic acid,) I have experienced great benefit from the application of 40 bushels of lime per acre. I am, however, perfectly satisfied, from observations pursued in the earlier part of my life, in the north of Lancashire, and also from examples which I have seen more recently in the west of Ireland, that no tenant with capital will ever be induced to embark in such an undertaking as the reclaiming of heath soils of the first class, unless of the most fertile description. The impediment to the progress of the plough, in consequence of the great quantity of boulders and projecting rocks which are always to be found in such places, almost totally prevents the application of that important implement, whilst the cost of the push or breast-plough, together with the expense (if such is the mode that has to be pursued) of trenching the land, the removal of stones and erection of fences, makes the cost too high for the anticipated profit for any prudent man to embark his capital in such an adventure. To a spirited proprietor, however, who is anxious to increase the value of his estate, provided he could receive a fair return for his capital, and at the same time desirous of improving the condition of the surrounding labouring population, the improvement of this first description of heath lands offers a wide field for secure and profitable investment, provided he either fully understands the matter himself, or otherwise has a steward perfectly acquainted with the best mode of directing such undertakings. It is impossible, in a paper like this, to at all exemplify, except in a very general manner, the most expedient modes; as heath lands vary so much in their character, that at every five or six yards the soil may be of a totally different description. Allotments, however, of from three to ten acres each, with a proportional right to put a certain number of sheep on such parts of the mountain as may be deemed irreclaimable, is decidedly the best mode of proceeding, and would in time (were such projects countenanced) convert many a dreary waste into the comfortable farmsteads of content and industry. The

introduction of flax cultivation (for which many parts of heaths, such as I am now considering, would be admirably adapted) would greatly aid and assist such enterprises, as the various manipulations connected with flax would employ all hands during the winter season, and would at the same time give considerable employment to the females of the family during winter evenings, by converting a portion of the flax into yarn, either for sale or domestic use. Paring, burning, and liming, (if humic acid be present,) are the first operations in breaking up heath lands—the paring to be done by the plough, if possible; and when paring is impossible by the plough, on account of rocks and stones, all profit to an ordinary farmer, in such undertakings, is perfectly visionary.

I have had considerable experience with respect to the cultivation of heath lands of the second class, having possessed a farm in Ireland some time ago, which, at the period of my taking possession, was, with the exception of a few acres, totally in a state of nature, and possessed, more or less, all the qualities of soil that could possibly be included in this class. The result of my experience is, that paring and burning, with liming, is indispensable on this class of soils, and that one hundred bushels of lime per acre is the minimum that ought to be applied; that it will not repay the tenant to perfectly drain, with stones, lands of a moory description, with only a depth of four to six inches available soil, as the cost cannot be estimated at less than L.10 per acre, it being more profitable to him to plough the land into flat ridges of eight to ten feet width, and plough or shovel out the soil close to, or an inch below, the subsoil. I had a complete example of the inefficacy of leaving sods to rot whilst I had possession of this farm, having left four acres for nearly four years to undergo that slow process of decomposition, the result of which was, that the sods were, at the expiration of the four years, nearly as tough as they were the first day they were cross-ploughed.* On the same four acres, I also witnessed the effect of burning. Some parts were completely composed of peat, but the greater part was a mixture of peat-clay, &c.; in fact, to a casual observer, would appear to be a fine fat earthy loam. The spring was getting far advanced, (May,) and several showers occurred to stop our progress in burning, so that only small patches were burned, and those mostly consisting of peat. I was, however, determined that an experiment should be made with this piece of land that spring, and the whole was sown with mustard (white.) The con-

* Cross-ploughing heath lands is a most difficult process. I did not see, until after I had left Ireland, the account of a machine invented by Mr A. Brown, Carrabus, island of Islay, and inserted in the seventh volume of the Highland and Agricultural Society's Transactions. It appears admirably adapted for the purpose.

trast between the unburnt and the burnt was most astonishing; the stalks of the former reaching about 27 inches, rarely above 30 inches in height, whilst on the latter they reached from five feet six inches to six feet high, with a corresponding luxuriance of foliage; the leaves more resembling the vine-leaf than that of the mustard plant. It was in a fruitless effort to cultivate this farm without the aid of lime, that I arrived at the conclusions I have done with regard to the *modus operandi* of that substance as a fertilizer, having made several experiments, some on a large, and others on a small scale, to cultivate the following plants without lime, viz. potatoes, buckwheat, rye, oats, mustard, rape. Potatoes, (after paring and burning,) I found, will grow very well on such lands without liming, as also will the following crop of oats; but the grass seeds which succeeded always possessed a sickly yellow appearance, and were speedily overrun with the rumex acetosella, (sheep-sorrel,) and became almost of less value than it was previously to being broken up. Buckwheat grows well on such soils; rye the same; oats tolerably; mustard and rape not at all: yet the same soil, when burned and limed, produced mustard, rape, cauliflowers, cabbage, and mangel-wurzel, all of the greatest luxuriance. This obviously arises from the fact of the burning liberating so much carbonate of potash. It has frequently been observed, that burned heath land is sooner exhausted, if cropped for a continuance, without the use of lime than with. This has given rise to the erroneous impression, that lime acted as a manure, and added some fertilizing matter necessary to the growth of plants. The rationale of the process, however, is this: when we burn a quantity of turf, we return to the land the whole of the mineral constituents of the plants thus burned in a state fit for assimilation by another race of plants, amongst which a considerable quantity of potash (the most important mineral ingredient of plants as regards weight) in a free state. It has been previously shown that humic acid is held in solution when potash is present. It is evident, therefore, that the liberated potash combines with the humic acid of the soil, and forms the soluble humate of potash, which is being constantly carried away by every shower of rain. In this manner one of the most important mineral ingredients of our ordinary cultivated plants is carried away, and lost to the cultivator. It was in consequence of observing, whenever a shower of rain took place soon after a paring and burning, that the water in the hollows of the land was of a much deeper colour than at ordinary times, that I was led to conclude that it was the action of the alkalis on the soil which was the occasion of the infertility of moory soils [illegible] lime prevents the action of humic acid on [illegible] potash [illegible] perfectly evident that in so doing

it greatly retards the waste of the free potash in the soil, and consequently prolongs its fertility.

Having gone through a description of the entire *modus operandi* of the action of lime, and that of the operation of paring * and burning, I will now give a little attention to the course to be pursued in reclaiming deep bogs. Waste lands of this description, wherever there is sufficient fall for the drainage of the superfluous water, offer the greatest temptation to the investment of capital; as I have never known an instance in which an undertaking of the kind has been unattended with profit. I am convinced, however, that tile-draining is not adapted to such lands; but large open drains, to carry off the water quickly, which is surface draining, are the most expedient. The mode of cropping to be pursued, both on this and the moor soils, may be similar to that pursued in the Fens, viz. rape eaten off with sheep, oats, wheat, and grass seeds, to be broken up agan in four or five years.

In regard to the cultivation of sandy heaths, I have to observe, that if the nature of their composition is taken into consideration, we must arrive at the following conclusion—viz. that it is inexpedient to have recourse to burning much of the vegetable matter contained on such heaths; however, it is indispensably requisite that we should get rid of the original coarse herbage.† After such heaths have, however, been ploughed and cross-ploughed, during dry weather, a roller should be run over the same, and afterwards an ordinary drag-harrow or cultivator. If the whole of the earth be not shaken out of the roots by the first operation, it must be repeated—twice will almost always have the desired effect. The great fault of sandy soils is the want of the mineral constituents of plants. It would, therefore, be advisable, on the breaking up heaths of this description, that after the coarse plants are burned, and a slight liming given, (humic acid always being present in sandy heaths,) turnips, drilled with bones and a little potash of commerce and guano, eaten off with sheep, and then sown down with appropriate grass seeds, is the only mode that I can conceive will ever suc-

* I ought to remark, that in deep bogs, when it is expedient to burn the surface to a considerable depth, a very expeditious mode of forming the heaps is by using a singular implement, called a " bob" in Lincolnshire, which, with one horse and man, will do a most surprising quantity of work in the course of a day: it is a species of high, but short, horse-rake.

† It has often ocurred to me, that were salt plentifully distributed on such soils, or other heath lands, or steep places, so as to destroy the original coarse sward, then applying a little lime, and afterwards sowing the better description of grass seeds, would be a cheap and effectual mode of converting sour pasture into a tolerably fair one. Had I continued in Ireland another year, I should certainly have tried the experiment.

ceed in improving sandy heaths. To crop such soils would be madness, unless in a neighbourhood where plenty of manure is to be obtained; in which case, turnips, carrots, and potatoes may be grown with advantage, also rye and buck-wheat.

No course of cropping can possibly be recommended for heath lands, circumstances being so widely varied. As a principle, however, and founded on very extensive information, I should say, that when heath lands are to be reclaimed, let it be done in such a manner as will convert the same into the best possible permanent pasture, *and let it remain so.* Crop as little as possible; as, if you do, the whole of the produce will be brought to the homestead, generally at some distance from the reclaimed heath, and it is consequently a hundred chances to one if any of the manure arising from the produce of the heath ever sees its way back again. Decidedly, the most profitable mode of proceeding, when heath lands are broken up, is, after paring and burning, (and liming, if needed,) to sow some green crop; turnips, if a hazel, stony loam; rape, if peat. Soil with sheep, and sow appropriate grass seeds. To the farmer, I am convinced no other mode will be *eventually* found profitable. With the tenant, however, of small allotments, the case is very different; and, as before observed, were the occupiers of such allotments instructed in the cultivation of flax, and were belts of elder planted for screens from the most prevailing winds; and were, in addition, coppices and small clumps of larch, planted in appropriate places, large tracts of heath might be rendered serviceable to a hardy and industrious population. With respect to altitude, I may remark, that flax may be cultivated at 400 to 500 feet above the level of the sea; oats at 900 to 1000 feet. The most appropriate mode of husbandry is, however, green crops, and the soiling of cattle, with a small admixture of sheep.

ON INSURANCE SOCIETIES FOR FARM-STOCK.

By Mr T. W. Lorimer, Aberdalgie, Perthshire.

Whatever diminishes the *loss* on capital employed in any particular channel, tends, equally with that which increases its *profit*, to lead a greater amount of capital into that channel.

There are two classes of measures which promote the application of capital in different lines by operating upon *losses* in those lines. We mean *preventive* and *distributive* measures. There is, on the other hand, another class of measures which render *profits* avail-

able in promoting any branch of industry, viz., *productive* measures. Theoretically, we might also suppose institutions for the *distribution* of unforeseen profits, by an annual premium to be paid *to*, in place of being paid *by*, the party to whom such casualty might occur. But it is evident that, however useful insurance societies against losses are to the community, such insurance against profits is *practically* an absurdity.

Of the two classes of measures which operate upon loss on capital, the first, viz., preventive measures, are evidently the most useful. *Preventive* measures diminish the aggregate loss to the community; *distributive* measures only tend to equalize that loss among the members of the community. There is also this further objection to the latter, that there is always some risk of its interfering with and counteracting the far more important workings of the former. To whatever extent distributive thus interfere with preventive measures as to loss—in other words, so far as insurance societies interfere with the proper exercise of the surgeon's lancet, the mariner's compass, or the fire-engine, which may be taken as the three types of the preventive measures—thus far such societies become to the public a nuisance in place of a benefit.* The greater or less probability of such interference between these measures against loss in regard to different subjects, is that on which the difference in principle between life, fire, marine, and, we may now add, stock insurance societies is in a very great measure founded.

The most important points to be determined in establishing any insurance society, seem to be the following:—*First*, Whether the society is to be a *Mutual* or a *Proprietary* one—that is, whether the parties insured, or others, are to be the insurers; *second*, What proportion the premium of insurance is to bear to the value of the policy; *third*, What proportion the value of the policy (*i. e.*, the amount recoverable in case of complete loss) is to bear to the full value of the subject on which it is granted. We will make a few remarks on each of these points.

Much disputation is carried on between the supporters of the two rival systems of insurance, the Mutual and the Proprietary. Cattle Insurance Societies have of late been established in England (as they had previously been in several Continental countries) on each of these systems. That on the former is termed

* It must be observed, however, that where the value of the subject destroyed consists almost entirely of the amount of labour employed on it, the loss of this subject may, in certain circumstances, be nearly compensated to the community by the employment afforded in renewing it. Thus, insurance of buildings (even in so far as it may promote their destruction) does not prove so detrimental to the community as insurance of any products of the soil.

"The Farmers' and Graziers' Mutual Cattle Insurance Association;" and the other, the "Agriculturist Cattle Insurance Company." Both of late have been establishing agencies in Scotland, and resorting to the common (though not very creditable) means of raising themselves, viz., by each endeavouring to lower its rival.

The gist of the argument in favour of mutual insurance is, that no extra amount of premium is required from the insured to pay to other parties the interest on capital paid up by them; that, in fact, little more is required as the amount of premiums, than the average annual amount of payments for the loss of subjects insured; and that this small excess of receipts over disbursements in *average* years, is laid up as a reserved fund to meet the deficiency in a year of great loss, or reverts to the parties insured and insuring as a bonus. It is argued in favour of proprietary insurance, on the other hand, that an originally paid up capital is necessary as a security in case of a great run upon the company in a very disastrous season; that it is better that the party insured should pay something additional as premium, than be forced to become a shareholder in, and take all the risks of, a speculation as to the character of the other shareholders, of which he is uncertain. Now, it seems to us, that neither system is in all cases the best. Each has its peculiar province. If the number of shareholders in a mutual society is very large, and the subjects insured scattered over the whole country, the great loss in some localities is almost certain to be counterbalanced by a small loss in others, in which case such society is as secure as that with a large paid up capital; and if the premium is made lower, or an occasional bonus returned, there is considerable inducement to prefer such a mutual insurance society. On the other hand, for a society transacting a small amount of business, and that in a narrow district, the proprietary system is certainly the most secure one. The Proprietary Cattle Insurance Company contends, that though mutual insurance has been very successful when applied to human life, houses, &c., the insurance of stock on the same principle cannot be secure, from the loss by infectious diseases among cattle being so very much greater in one year than another. We cannot perceive the great distinction between the special and the general case. It appears to us that the stability or instability of a mutual cattle insurance society, as well as of any other mutual insurance society, depends entirely on the number and distribution of its policies. If the amount of stock insured is very large, and, what is still more important, if it be generally distributed over such a space as Great Britain and Ireland, the mutual principle may, we think, be safely applied even to it, for, though we have sometimes simultaneous reports from many districts of

great loss from murrain, we are not aware of this or any other very sweeping disease having ever in one year prevailed throughout nearly the whole extent of the three kingdoms. In fact, we would venture to affirm, that over such an extent, the variation from year to year in the number of deaths, from all diseases, among farm-stock as among the human species, is very small.

Now, applying these simple principles to the two societies alluded to, we find that the Mutual society advertise to have upwards of 2000 members, and a list of patrons of very high standing, with the Duke of Richmond at the head; the Proprietary company, again, advertises to have a capital of £500,000, in 25,000 shares, and to have issued upwards of 3500 policies. The above number of shareholders in the Mutual society may not perhaps appear sufficient to inspire very great confidence in it; but it must be kept in mind that the distribution of the stock throughout a wide extent of country, (and we presume the stock insured by it is so distributed,) is a matter of still greater importance than its amount; and this society having only begun business two years ago, (viz. in March 1844,) the number of policies already issued shows that it has obtained a fair share of public confidence.

The *security* of both these societies appears, therefore, to be pretty good; and though in that respect the Proprietary one has certainly the superiority, still, if the premium required by the other were much smaller, such difference would probably make most farmers adopt that requiring the smallest outlay; but, in fact, no such difference exists. The premiums charged by them are almost exactly the same. The reason of this seems to be, that the mutual association *at present* requires as large a surplus to establish a reserved fund, as the proprietary society requires to pay the interest on its capital already paid up. On the whole, then, we should say, that for those who have merely a prospect of insuring their stock for a few years, the Agriculturist (or Proprietary) Cattle Insurance Company appears to be the most suitable, as involving less risk, without requiring a greater outlay than the other; but that, as to those likely to insure during a long series of years, the interest they would obtain in the accumulating reserved fund—the future reduction in their premiums—or the bonus to be returned, and the always increasing security of the association, as its business extends, ought to induce such persons to prefer the Farmers' Mutual Association.

The *second* point to which we proposed to allude was the proportion which premiums of insurance ought to bear to the amount of the policies. This, as well as the third point, viz. the proportion between the full available or recoverable amount of these policies, and the full value of the subject on which they are

granted, depends on the chance of the destruction of that subject. This destruction may be either unavoidable, or from neglect or fraud. These are two distinct sources of loss, and the means of providing against them may be equally distinguished by insurance companies.

The way in which this distinction between unavoidable loss, and loss through neglect or fraud,* ought to be, and to some extent is, carried out by insurance companies, is by first regulating the proportion between the premium and the policy by the risk of *unavoidable* destruction; and, secondly, by regulating the proportion between the amount recoverable on such policy, and the value of the subject on which it is granted, by the additional risk of loss through fraud or neglect, which it might be impossible to prove.

The calculations of insurance societies have hitherto been almost entirely founded on losses supposed to be unavoidable. This clearly results from these circumstances, that human life is guarded by the strongest laws, both divine and human—that shipwrecks risk human life—that fire-raising, when through neglect, also involves a risk of human life, and, when wilful, is one of the most severely punishable crimes on our penal code. Hence, Life, Fire, and Marine insurance companies all grant policies on their respective subjects to about the full amount of their value. Not only so: our life insurance societies insure their subjects far beyond their value, if calculated on any worldly scale of usefulness. Though a man's life should be a burden to his friends, these societies yet venture to promise them an immense sum at its conclusion for a proportionately small one during its continuance. No stronger proof of a nation's morality can, we think, be given than by its speculators for gain thus insuring the life of a fool or a rascal for a large sum. The per centage on the policy, which must be paid as premium, then comes to be, with life, fire, and marine insurance companies, almost the sole, and with stock insurance companies the chief, matter to be calculated. Such calculations must, of course, be made from an induction of facts stretching over a wide extent [illegible] space and time. Both the collection of these facts, and [illegible]lations founded on them, seem to have been conducted [illegible] and judgment by the stock insurance companies under [illegible] We have said that the premiums charged by the [illegible] are, notwithstanding the different principles on [illegible] they are founded, almost exactly the same. They vary

* The neglect and fraud here meant is only such as *cannot* be proved against [illegible] parties guilty of it, as no insurance company becomes liable for the effects of [illegible] it can be pro[illegible]

according to the different kinds, ages, and modes of treating the stock. The following are a few of the chief items. By both societies the premium charged for draught horses used exclusively for agricultural purposes, and between two and fourteen years old, is $2\frac{1}{2}$ per cent. On those used occasionally for other purposes 3 per cent (or 60s. per £100.) By the Agriculturist Company $3\frac{1}{2}$ per cent for carriage horses, hacks, &c—4 per cent for dray horses used in towns—5 per cent for blood and cart stallions—6 per cent for high-bred brood mares—and 4 per cent for high-bred colts. The Farmers' Mutual Association advertise to insure these latter classes by special contract. For protection against death by glanders an additional 1 per cent is charged. Both companies charge $2\frac{1}{2}$ per cent on neat cattle and cows, and 2 per cent on feeding cattle; and when these classes are not protected against pleuro-pneumonia, the premium charged is only $1\frac{1}{4}$ per cent. The Agriculturist Company further offer to insure young stock between three months and two years old against all disease and accident for 2 per cent; the changeable stock of graziers for 3 per cent; prize stock valued under £100 per head for 4 per cent, and those above £100 per head for 5 per cent; single cows in the country for 3 per cent. Death from blackleg is only insured against when a seton of hair or tow three inches in circumference has been introduced through the dewlap of the calf at the age of three months, and kept in operation by occasional dressings till the age of eighteen months. The Agriculturist Company also insure all ordinary sheep above three months old against all diseases and accidents, except rot, for 5 per cent. Boars, sows, and pigs above three months old for 5 per cent in the country, and 6 per cent in towns. These, and other classes, are insured by the Farmers' Mutual Association by special contract. It is a regulation of both societies that twenty-one days of probation must elapse after the day on which the proposal of insurance is made before the insurance actually commences.

It must be observed, that the above are per centages upon the full estimated value of the stock *at the time of insurance*, (which valuation of stock and renewal of insurance takes place once a year,) and as the *nominal* amount of the policy coincides with this valuation, they may also be said to be per centages upon it. They are not, however, the exact per centages on the available or recoverable value of the policy, for that being (as shall afterwards be noticed) only about three-fourths of the market value of the animal before being taken ill, if the stock should die at the commencement of the year, the sum recoverable is only about three-fourths of the nominal amount of the policy; whereas, should the death occur at the year's end, the sum recoverable

may, from the increased value of the stock, exceed the sum named in the policy, or, from its diminished value, (as in the case of old horses and cows,) the sum recoverable may be even less than three-fourths of the valuation in the policy. Such a discrepancy between the proportions which the premium bears to the nominal amount of the policy, and to the full amount recoverable on it, is unavoidable in insuring a subject of which the value is constantly varying.

We are not prepared, from our own experience, to give an opinion as to whether or not the above premiums are too high. All we can say is, that we fear farmers generally will be very slow in paying such a premium as is necessary for the prosperity of such a society. We do not say this at all with the view of discouraging such insurance; but to warn those who may be inclined to consider the matter, not to be driven from their intention of insuring by finding, that on their limited calculations of their own and their neighbour's losses for a few years, the premiums charged may appear too high. The great object of such societies is not to indemnify the party insured against ordinary losses, such as he sees often around him, but against the almost total loss of the stock on a farm from some epidemic such as may only occur there once in a century, but which might then ruin the occupant. In cattle insurance, as well as every other kind of it, there is most inducement for him to insure who has his goods all in one lot, of which the safety is so far conjunct. Thus the proprietor of many houses in different parts of a city, or of many ships on different seas, has little need of insuring any of them. So the occupant of several farms in different parts of the country may be expected to be the last to insure his stock, as his different herds form a sort of insurance society among themselves. This we have heard stated as the feeling upon this subject of several such farmers, and a very just and natural one it is. We beg, therefore, to impress upon small farmers, and even cottars, whose animal property is, as it were, bound up in one parcel, that they must not wait for great stock farmers showing them the example in insuring their stock, since these have but little interest in such a *distributive* measure, however deep their interest may be in all *preventive* measures against loss of stock.

The *third* point which we proposed considering, was the proportion between the full available or recoverable amount of the policy, and the value of the subject on which it is granted. Both of the Cattle Insurance Societies under our notice have fixed the former at rather more than three-fourths of the latter. Their rule as to this is,—that when an animal dies, the party insuring it shall receive three-fourths of the value of the animal in the market the day before it was taken ill, and one fourth of the value of the

offal. As a further precaution against fraud or neglect, both Societies have established a long list of very stringent conditions, which must be strictly complied with by the parties insured. It would occupy too much space here to detail these conditions, which can easily be got on application to any of the agents. All we have to say of them is—that we would ourselves dislike the trouble—such as that attending the change of a single animal, the anxiety about feeding, &c., the expense, such as that of sending a messenger immediately for the inspector when a serious illness occurs—the probable difference of opinion among veterinary surgeons as to the disease with which the animal is affected—as to the propriety of killing it at a particular moment,—or as to its market value when taken ill; and, finally, the probability of disputes on these and many other points ending in law-suits, though some provision is made for settling them by arbitration; to all which, and many other annoyances, the holder of the policy is subjected. We are very apprehensive that such strict conditions will be the greatest obstacles to parties inclined to insure their stock. Might not several of these conditions, such as the necessity of the inspector's attendance, be dispensed with, provided the amount of the policy bore a smaller proportion to the value of the subject over which it is granted? *If the Company became bound to pay only one half in place of three-fourths of the value of the animal dying, they might then trust to the owner, for his own interest, using all due means for the preservation of life.* Some further simplification might also, we think, be effected, by making the rate of premiums more uniform for each kind of stock, with fewer distinctions as to age and kind of feeding. And we also question whether the distinction of diseases can be carried out with a practical good effect at present. This last may indeed, as is argued, lead to the improvement of the veterinary science, which would no doubt be a public benefit. But this, and many of the conditions before alluded to, are refinements, some of which we think ought only to have been afterwards engrafted on the system, and which system would have much better recommended itself *at first* to farmers had it appeared in a form more simple. We would not have presumed to make these criticisms from our own judgment, had we not heard the substance of most of them expressed by several very extensive and eminent breeders and feeders of stock.

ON THE POTATO DISEASE.

By P. F. H. Fromberg, First Assistant in the Laboratory of the Agricultural Chemistry Association of Scotland.

On reading the above title, not a few may be induced to expect here something entirely new, some strange, more or less, founded opinion upon the cause of this most serious calamity, with which various countries have last year been visited, and of which certainly nobody will be able to foresee the end with any degree of probability. Multifarious as the statements and accounts have been of this disease, different as have been the opinions advanced upon its origin and nature, some of them by men entitled to give a public opinion, it would be presumptuous in me, whose attention is mainly directed to other sciences than that of agriculture, to throw my own opinion into the scale, overloaded with those of others.

I shall, therefore, only in so far give something answering to the title, as regards strictly physiological principles; but, before doing so, I shall give an abridged account of the statements and opinions made and entertained by some well qualified judges in other countries, especially in Holland, where the disease has prevailed to a most alarming extent, and very much attention has been paid to the subject. This way of treatment will serve to bring the whole under one heading, and thus may assist in taking a more regular view of the subject.

I shall take these abstracts in their order, and commence with

The Report of the Royal Institution of Science, Literature, and Fine Arts of the Netherlands, First Section, in Amsterdam.

16th September 1845.

1. *Causes of the disease.*—The moist weather of the year 1844, combined with the influence of the protracted cold in the spring and early part of the summer of 1845, and the sudden transition from co[illegible] July are considered as the remote causes[illegible]

[illegible] influences—that is, the [illegible], the well-known professor of botany [illegible] of the Royal Commission, thinks that [illegible] the continual rains in the autumn of 184[illegible] stored only half dried. The protracted

winter and cold spring prevented a thorough working of the soil; and thus the cutting, in bad condition already, came into a soil unfit to bring the fruit to maturity—a defect which cannot be counteracted by manuring the soil. In addition to these influences came the parching drought of the middle of June and the beginning of July.

Another member, Professor Van Hall of Groningen, states, in addition, that the cuttings were sometimes kept in damp and unaired places. He thinks the very cold winter of 1844–45 had nothing to do with the disease. It is a cutaneous disease, or mould on the leaves, which has been subsequently transferred to the subterranean fruit. This multiplied mould-production was the effect of atmospheric influences, and was extended by infection.

Another member, Mr Brants, an experienced observer with the microscope, agrees in the main with the two former members. The plant grew too luxuriantly, through excessive heat, in June and July. The cellular tissue was developed too slowly and irregularly, of which a kind of dropsy was the result. Hence the withering of the leaves, and their want of physiological action upon the tuber. The scorching heat, after the wet and cold days, acted in the same manner as if unripe potatoes were placed in damp pits. He thinks, however, that the watery condition of the potato, and subsequent tendency to putrefaction, were caused not only by atmospheric influences, but also by overcropping, which has the effect of making the increase of starch inferior, proportionately to the increase of the number of plants on an acre.

2. *Nature of the disease.*—The members are all agreed that the phenomena of this disease are different from those of the dry rot and the scab, as described by Martius. This has been chiefly proved by Mr Brants, through microscopical examination. The upper parts of the leaves are generally the first affected; the extremities are covered with small black points, become gradually wholly black, and shrink. The petioles have black spots, under which they have internally a sickly appearance; and finally, they commence either to putrefy or to dry. The same black spots also covered the stalks, but there they are confined to the epidermis. The stalk generally dries, and rarely rots. On the under part of the leaf, the epidermis of the green places, bordering the mouldering spots, has undergone a change, and its cells are easily loosened. The vessels and elongated (pleurenchymatic) cells are filled with a brownish liquid, but the parenchyme remains green. The fungus is called *Fusisporium solani* by some; but Mr Brauts states that it is another species, without

articulations, with a different ramification, and having round, undivided sporules, with granular contents. On further microscopic examination, the plant exhibits the character of an earlier period of development, for there is a multitude of vessels; the cellular tissue has an unusual form, the spiral vessels are not yet completely filled, the starch is irregularly distributed, and is wholly absent from the external layers. Even in apparently sound parts, the intercellular canals are filled with a brownish, granular fluid. It was only in cases where putrefaction had *positively* set in, that a foreign organic tissue could be discovered, being the *protomyces* of Unger, but never those rudiments of mould plants, or fungi, which are represented by Von Martius. The true *Fusisporium solani* was found by the observer only in cases where the epidermis was injured, and the cellular tissue exposed to the air. Generally, the fungus is accompanied by infusoria and the *Acarus farinæ*.

Some of the members are of opinion, that the disease extends itself downwards, because those tubers which spring highest from the stalks were attacked first, whilst those lower down were still sound, and could in some measure be preserved by earthing up the soil around the stalks. Others regard the withering of the leaves as the effect of the degeneration of the tuber. This point can only be made out by deciding, whether the fungi are the cause or the effect of the disease. The latter opinion has a powerful support in an observation by Mr Brants, that there is a specific difference between the fungi on the leaves and those in some tubers; for recent discoveries in pathological anatomy have shown, that on diseased organs of the animal body moulds may be formed; and thus the observation of Mr Brants would lead us to suppose that the diseases of leaf and tuber are different from each other. In support of this view, Professor G. Vrolik has shown a potato plant, taken from a number of the same description, of which the leaves and the very lowermost tubers were affected, whilst those between, under the immediate surface of the soil, were perfectly sound.

As to the influence of the soil, not one has remained free. In general, those on sandy soils have suffered less than those on clay soils. The potatoes were attacked on spots even almost entirely enclosed. This seems to be in opposition to the idea, that the disease is caused by germs of cryptogams, carried through the air.

As to the means of stopping, moderating and preventing ... of the disease, these must vary with the assumed ... f these are cryptogams, then it is advisable to apply ... ime-water, or dilute sulphuric acid. This pro- ... unfit for ... a large scale in the

field. If the fungi are only the effects of the disease, then this remedy can do no good. The only answer upon this question that can be given is, to employ sound seed upon a healthy soil. Next year, no soil should be cropped with potatoes where they were grown in the former years. If this should be inconvenient, then

1°. The diseased leaves and stalks must be burned on the field.

2°. All useless potatoes must be destroyed.

3°. The soil must be manured with lime, and well ploughed during the winter, but not harrowed, to give full access to air and winter frost. In the spring, it should again be manured with lime, or irrigated with dilute sulphuric acid.

4°. It is of importance to select dry soils, and to plant the potatoes in wide rows, at considerable distance from each other.

As regards the crop obtained, the tubers must not be lifted before they are perfectly ripe and dry, and they must then be separated from the adhering earth, washed, and spread out to dry completely.

*Report of the Commission for Agriculture in the Province of Groningen.**

The Hague, 15th September 1845.

I.—*Cause and Nature of the Disease.*

1. These are predisposing causes, viz.

1°. The wet summer of 1844. There was a continual rain at the time when the potato was most in the act of ripening. Many potatoes, which have afterwards served as cuttings, came out of the soil in an unripe and undried state. It has been observed in some places, that this year a greater number of the planted potatoes than in former years did not shoot.

2°. The insufficient care that is taken for the cuttings, such as the keeping them in damp places, which gives rise to fermentation and decay. This is, however, not a general cause.

It is highly improbable that the severe frost, especially in the month of March, should have been a cause of the disease of the cuttings. There are 22 varieties of potatoes grown in the economical garden of Groningen, and these are all diseased, although

* The present document has already been published, by way of extract, in the Irish papers. We consider it, however, desirable to give here its chief contents.

they have been kept in the greenhouse of the garden throughout the winter.

2. The more proximate causes which have co-operated together to produce the disease are,

1°. The uncommonly luxuriant state of the crop, which rendered it very subject to exanthematic diseases, in connexion with cryptogamic plants, as is the case with corn.

2°. The great heat in the forepart of the summer of 1845, which was, for instance,—

On the 13th	of June,		87°	Fahr.
———	3d	— July,	87½°	——
———	7th	— ——	91½°	——

The heat was so great, that instances have occurred of people being killed by it on the field. Some weeks later, the soil was still so hot, that it was disagreeable to the hands of the weeders. Potatoes that were nearest to the surface were tainted the first. When the soil had been earthed up around the plant, or where the potato had got accidentally more covered, the disease appeared much later.

3°. The wet weather, which lasted almost without intermission from the half of July till the end of August. Dampness, and want of sunshine, could but promote in these succulent and overgrown plants the tendency to rot, and the development of fungi, especially since, in the same periods of the former year, the same causes had been in operation. The protracted and repeated actions have been chiefly effectual here in influencing the organism.

The disease extends downwards in the plant—commences in the leaves, and has communicated itself, by the juices in the epidermis, to the subterraneous parts, chiefly to the epidermis.

By all the said causes collectively, the plant has been imparted with a strong tendency to decay and mouldiness; and the moulds, once formed, have propagated themselves with almost miraculous rapidity, favoured by the peculiar state of the weather.

3. The *immediate* cause, or nature of the disease, is an exanthema or mouldering in the leaf, by which deadly juices, which caused putrefaction to commence, have been carried downwards into the plant. Rust in corn causes decay along the same nerve of leaf by which it proceeds.

The disease of the stalk and tubers must be considered more as an effect of that in the leaves, than as being of a separate character.

All this agrees with the direction taken by the disease. It very often originated on a certain spot of the farm—often a low or peculiarly rich spot; and from thence it spread with the utmost rapidity, as if by infection. Several observers think they have perceived that the disease followed in some degree the direction of the wind, and that in a field protected by thick wood, it appeared first where an aperture existed.

Another ground, that the real nature of the disease is a peculiar fungus, seems to be afforded by the fact, that no other plant, standing close to the diseased potato, has been affected in a distinct manner, even although they were in immediate contact with the potato leaves.

The present disease has been more or less noticed before, but not described by any living naturalist. The dry rot of Martius and the scab have their origin in the tuber, and are therefore different from the present disease.

II.—*Means for Preventing the Return of the Disease.*

1. The potatoes should be left long in the ground, till they can be lifted completely dry. Potatoes that are tainted putrify sooner, by the act of lifting them.

2. This precaution is especially necessary for those which are to be used as seed for next year's crop. It would be advisable to take, for this purpose, potatoes from sandy soils, because the disease has prevailed there much less than on clay.

3. The diseased leaves and rotten potatoes must be burned, and completely destroyed upon the field.

4. Potato fields for next year should be manured with lime, well ploughed, and left unharrowed through the winter.

5. Next year, potatoes should only be grown on dry soils. Spots that are in the shade of trees or houses must be avoided as much as possible. As this year the coarsest varieties, thinly planted, have resisted the disease longest, these should next year be used in preference to others, and planted in rows thinner than usual.

III.—*In case, however, that the Disease might make its appearance again, it is recommended that*

1. From the *very* commencement, the first affected leaves should be immediately cut down, and burned.

2. But as this, practised over a great extent of land, would do much injury to the crop, the whole field may be irrigated

about the evening with lime-water, or rather dilute su
acid.

3. If the disease might continue and appear repeatedl
advisable to have sufficient seed and cuttings of plants t
fit for feeding man and animals. These should be cul
where blanks have been formed. For instance, pease and
horse-beans, cabbage, and especialy root-plants, such a
bagas, turnips, mangel-wurzel, topinambours, &c. The
growing well upon sandy soils, endure the severest fro
both root and leaf are fit nourishment for cattle.

Report of the Commission for Agriculture in the Provinc Utrecht.

The Hague, 19th September

The disease is most on clayey soils, equally prevailing o of a heavy as on those of a light character; but on higl soils, especially in the east part of the provinces, it exi less degree.

All varieties, both early and late, are affected, although ferent degrees. On the whole, the early kinds are affecte Those planted *very* early, which were ripe and lifted bef leaves were attacked, have escaped.

Among the late varieties, those tubers were nearly ε which were almost full grown when the disease appeared leaves.

On the whole, the better varieties, with fine leaves ar flowers, are more affected than those with coarse leav white flowers. Since many years, the potato crop stood universally advantageous, as in the forepart of the summer year, and almost every where a double, nay treble crop, v pected.

After the leaf had become withered and lost its colour, flower dropped, the tuber itself was affected at the spot the stalk had been inserted.

The two main views as to the causes of the disease ar it is to be ascribed either to the deteriorated quality of t tings, or to an injurious influence of the atmosphere.

The former opinion is inadmissible, for several reas which we will here only state, that whether this degen might be considered as an effect of cultivating the plant on of soil, or repeatedly on the same soil, or of mixing toget different varieties, &c., this decrease of the qualities of the may consist in a certain change of the tuber, without in that it should be called diseased. Besides, those varieties

have been introduced only a few years ago, have been attacked by the disease simultaneously with the rest, and as it were suddenly.

We must, therefore, look for external causes, to account for the present disease. But it is uncertain which influence is to be accused with the greatest probability; either cold, frosts, fogs, or the extraordinary heat in the commencement of July, and the subsequent refrigeration of the atmosphere, accompanied by continual wet weather.

That an atmospheric influence is to be considered as the cause of the disease, is further probable from the fact, that in fields situated under, or surrounded by dense plantations of trees—such as apple and other trees—the potatoes appear mostly sound, and that they were diseased in adjoining and open fields.

Other circumstances, however, must have co-operated with this atmospheric influence, and as such may be considered the coldness of the clayey soils, in consequence of the late frost and the cold in the month of May. The early planted potatoes appeared slowly, and grew badly in the beginning; but in June they grew so rapidly and vigorously, that for many years past such a luxuriant crop of potatoes has not been witnessed.

It has been observed, that here and there other plants, especially buckwheat, beans, tobacco, &c., were effected similarly to the potatoes, although this does not seem to be generally the case in this province.

Dampness appears to have contributed something to the disease, for it exists most generally, and in a higher degree, on moist and low grounds, especially such as are of a clayey nature.

As to the means of stopping the disease, the most careful selection of seed potatoes for next year will not be sufficient to prevent the return of the disease, unless they are taken from fields where no disease at all has appeared among the potatoes, and situated as far as possible from those which have been affected.

It will further be necessary, that in the next year's growth, all those precautions and rules, requisite for the potato culture, as to soil and further treatment, be followed up with renewed accuracy. The neglect of these precautions is in a great measure to be considered as the cause of the degeneration of this main agricultural product, of which, for many years past, complaints have arisen.

It deserves a trial, if it might become necessary to use potatoes, covered with mouldiness, for seed, *to lime them*, as is done with wheat when blighted: for lime weakens the life of the fungi. It will, however, be always desirable that the cuttings are so sound, that this precautionary treatment with lime be not necessary.

Abstract of a Pamphlet, entitled, *Observations and Experiments on the Disease in the Potato of* 1845. By Professor G. Vrolik, Amsterdam.*

In addition to what I have stated in the Report of the Royal Institution of the Netherlands, I have uninterruptedly continued my observations and experiments, and I have more especially directed my attention to a field of potatoes, not mentioned there, because at that time the potatoes were not yet sufficiently advanced in growth.

I was engaged in reclaiming a large extent of heath, and this induced me to try, if potatoes could be grown in a soil recently broken up to a depth of rather more than six decimeters (about two and a half feet.) I selected a field somewhat larger than an acre. The working of the soil was not finished before the beginning of May, on account of the long protracted winter.

This virgin soil was manured in the following manner: On the field were dug out, at regular mutual distances of four and a half decimeters, triangular holes of the requisite depth, and each hole received the manure, of which I wished to know the effect. The manure was covered with a little soil from the heath, upon this the potato was laid, and finally, the hole was filled up with the soil. The manures employed were—Bolivian guano, African guano, farm-yard manure, consisting of the dung of cows, pigs, horses, and young cattle, and peat earth, dug out the year before. Upon the last of these four kinds of manure, the potatoes were laid down directly.

The potatoes were of three kinds, of which one was very coarse, and they were planted on the 12th of May. They were long in showing signs of growth. Those with farm-yard manure appeared first; the leaf was strong, and of a dark green. No difference was perceptible between the effects of the two guanos.

In August, when a field on my estate had all the leaves withered, and all the stalks dried up or rotten, those on the heath were still in full vigour, and gave no signs of disease whatever. Those on farm-yard manure were the first in giving signs of withering; they were lifted on the 3d of October, and gave a tolerable harvest of sound potatoes, which I am keeping for next year. The other three were allowed to grow till the end of October. They all four produced flower and fruit, thus forming a singular contrast with what was seen elsewhere. The potatoes were lifted

* The second part of this pamphlet, containing very interesting experiments, has just come into my posession, and will be communicated in substance in the next Number.

from 27th of October to 1st of November, before the stalks were withered, and they all were, without one exception, *perfectly* sound, and have continued so. This fact is highly important; for cuttings of the very same sort were planted on a different field, in another place, one in which potatoes are usually grown, and more than half of the crop was diseased.

From these facts I infer, that in addition to the generally prevailing influence, a specific cause was requisite to produce this specific disease.

Where the rains, particularly violent and continuous in the month of May, found a free passage through the sub-soil, the potatoes were entirely, or nearly, free from disease. The more retentive the soil was, the more fatal were the consequences. To this, no exceptions, as far as I know, have occurred in our country.

The disease of the tuber was *not* a necessary consequence of the withering of leaf and stalk. I, and many others besides, have often found healthy potatoes attached to withered stalks with diseased leaves. All that has been said or written against this view, is only founded on theories, taken without consent of nature.

I have attempted to support my view in the matter by experiments, to which I found the way by early experience. The shoots of a germinating potato, cut off and planted isolate, almost always produce a crop bearing tubers at the bottom of the stalk, rarely more than seven in number, but of one size, and edible. The parent potato remains perfectly fit to produce young plants. The number of potatoes produced from a single stem may be multiplied indefinitely, by taking the stalks from the plant and laying them in the ground. Accordingly, I took the stalks of diseased potatoes, which were not yet entirely rotten, separated from the parent stem, and placed them into the ground, in such a position that the upper ends of the still succulent leaves were exposed to the air, hoping thus to produce a new subterranean fructification. Although these stalks had the disadvantage of being entirely devoid of fibrillae, the experiment was sufficiently successful. Some of them were planted under glass, others in the open air; part of them got into a state of complete exsiccation; but, after about seven weeks, I found that the rest had produced new potatoes, of different sizes, some very small, but all perfectly sound. This is another strong argument in favour of my opinion, that the disease in the tubers was *independent* from that in the leaves and green stalks.

The separation of the stalks from the parent plant had no influence upon the experiment, for I obtained entirely the same results by raising the ground around the stem of a potato plant.

On lifting the tubers, I found those that were first grown all diseased, whilst the fruit springing from the air-stalk, round which the soil was raised so late as the 15th of September, gave a sound fruit.

I used the sound crop, growing luxuriantly upon my virgin heath-soil, to make experiments as to the infecting power of decayed and mouldered stalks. The conclusion drawn from these and other experiments, (of which we pass over the details here,) was, that if diseased potatoes are contagious, this is *not* caused by the substance, either formed or deposited, upon their leaves and stalks. I admit, as a fact, that diseased *tubers* are contagious for healthy ones; but although this is a just observation, the conclusion drawn from it is less accurate. We must consider, that from fear of increasing the decay, tubers *apparently* sound have been removed from the soil; but this could not stop the disease with which they were slightly, and many even imperceptibly, affected.

In a pit, in which I had sound and diseased potatoes mixed, I found to my surprise, when it was afterwards opened and emitted an insupportable smell, that the sound potatoes were taken from it, in equally good condition as if they had been kept separate. I obtained similar results, on purposely mixing sound and diseased potatoes together. From this, however, I do not by any means infer, that when putrefying and sound potatoes are kept mixed together, the former should not at last bring the latter into putrefaction. This would be contrary to experience. But the question here is, whether sound fruits can be made to assume a *definite form* of disease, by being in close contact with diseased fruits of a similar plant? As soon as a potatoe is wounded, or its surface injured, the case is different. The disease then goes from one fruit to the other by *direct* communication.

From several other experiments which I have made, I further draw this conclusion; that although sound potatoes are not affected by the disease of those with which they are in contact, they are affected when their surface is wounded.

It is known from experience, that some diseased potatoes, against the ordinary rule, have commenced to germinate from the moment they were dug out. This power is not possessed by sound potatoes until several weeks, or even months have elapsed. It would appear that in some diseased potatoes the change of materials or transformation, of which the power of germination arises, [or rather which is a *condition* necessary to the manifestation of that power, F.,] has taken place before they are loosened from the parent stem. With such diseased tubers in process of germination, I have commenced making experiments, which may produce important results.

To give a condensed conclusion, drawn from the above observations, I beg to state:

1. That potatoes of the same kind and condition, placed in different soils, have produced diseased tubers in the one, and healthy tubers in the other soil.

2. That the general opinion that the disease, after having commenced in the top of the leaves, descends into the tuber—the disease of the latter being thus an effect of that of the former—has appeared entirely unfounded. Plants, of which the subterranean part bore diseased tubers, produced some fruits from its parts above ground.

3. That the leaves and stalks, however diseased and covered with fungi they may be, have not the power of transferring their disease.

4. That diseased potatoes, however mixed up with sound ones, do not impart to them their degeneration, provided the latter be not wounded.

5. That when the diseased tissue of a rotten tuber is transferred upon wounded sound potatoes, a degeneration of the latter becomes clearly perceptible after eight or more days.

6. That it would appear that diseased potatoes planted in an infected soil, can produce sound fruits.

I intend, after all my experiments are completed, to enter broadly upon the development of my conclusions, of which especially the last-mentioned gives rise to important considerations.

Abstract of a Pamphlet, by Professor Morren of Liege, entitled, *Instructions Populaires sur les moyens de combattre et de detruire la maladie actuelle des Pommes-de-terre.* Bruxelles, 1845.

It appears to me, that all the observations and experiments made, tend to prove that the disease commences in the leaf. This part becomes first pale green and then yellow. When in this condition, its under surface, examined with the microscope, presents a slight formation of fungi. The next day these spots are black, and then the white fungus becomes better and visible. With the increase of these spots in size, the leaves dry and wither, and assume a brown colour. The fungus then disappears, and after a few days the whole of the shaw is dry and blackish brown. Then new fungi, of a somewhat different appearance, are produced upon the dead plant.

The commencement of the disease in the tubers is characterized by the appearance of yellow spots between the epidermis

and a white line, indicating the internal boundary of the bark of the potato. These spots become subsequently brown, and finally cover the whole of the bark, especially near the ends.

A fortnight or three weeks are sufficient to produce a complete putrefaction, which I call *wet gangrene*, it being a decomposition in presence of abundant moisture within the tissue.

It would appear from experiments which I have made, that although the disease usually proceeds from leaf to stalk, and from stalk to tuber, it can also pass from one tuber to the other.

The disease must not be confounded either with the curl or with the scab. The latter consists simply in an ulceration on the outer surface of the tuber. The curl renders the leaves dry, curled, and withered, which, although lessening the produce, does not bring the potatoes into putrefaction.

Cause of the disease.—The cause I consider to be a little fungus, belonging to the class of moulds, and the genus Botrytis.

Many little fungi are injurious to man and animals. Among plants, onions, chalots, hops, &c., are affected by them. Roses, violets, wheat, rye, oats, have each their peculiar cryptogamic enemies. The beet-root is attacked by another species of the genus Botrytis; the leaf becomes diseased first, and afterwards the root gets internally black spots, and decays.

This mould, or fungus, has the effect of making the sap of the potato as it were poisonous. This diseased sap, in descending from the leaves, is the cause of the black spots on the stalk. These spots are dead, as when attacked by gangrene.

It is very probable that the seeds of the fungus themselves, which are exceedingly minute, descend into the stalk and tubers along with the sap. In the latter I observed the botrytis in the act of formation after the potatoes had been dug out.

The little fungus is the cause of the disease, because it appears, in its first or youngest state, at the very commencement of the disease, and before its appearance no sign of disease whatever can be perceived in the plant. Further, when the seeds are introduced under the epidermis of a healthy plant, the latter becomes diseased. These seeds, from their extreme minuteness, can float wherever the air can enter freely. The same fungi, even of the same genus, have the same effects in silk-worms, hops, &c., as in potatoes.

Means of opposing the disease, and preventing its return.—1. When the leaves are much affected, it must be wholly cut down, without much shaking it, and burned immediately. This cutting must be done *in time*, for when the disease has once spread through the juices, it will be impossible to stop it.

2. If the tubers themselves are affected, the plants should be taken out of the soil and shaken; the diseased potatoes will readily fall off. It is best to use those which remain attached immediately, for probably they would later become diseased also.

3. If winter potatoes are to be grown upon the same field off which diseased potatoes have been taken, or if this field is to grow potatoes the next year, it must necessarily be limed with the following mixture: one half cwt. of lime, six lbs. of common salt, one-fifth lb. of sulphate of copper, all dissolved together in twenty-five gallons of water. This liquid should be poured over the soil. By this mixture the seeds of the fungi will be killed.

The same mixture may be used to lime the potatoes. Instead of injuring the germs, it will be beneficial to them; for only the weak, diseased eyes or germs, whose destruction will benefit the plant, will be killed by this treatment.

When potatoes that have already commenced to germinate are to be planted, the shoots must be cut off and planted by themselves, or the potatoes may be put into the ground with shoots and all. In both cases, however, care should be taken not to crack the shoots, and for this purpose the holes in which they are planted should be left open, and upon each plant a spoonful of the lime mixture thrown.

Von Martius has told me that the dry rot was more frequently observed in potatoes planted in the afternoon than in those planted in the morning; and this he explained thus:—In the afternoon the air is generally warmer and thinner, and the seeds of the fungi may thus be more easily transported than in the morning. As these seeds easily attach themselves to the potatoes while they are being planted, it might be tried to place the potatoes in the ground chiefly in the morning.

Treatment of bad potatoes.—The two prescriptions,—1. To dry the potatoes for 20 minutes in an oven heated to 176° Fahr., on the ground that the brown fluid by which the starch is surrounded then flows away; and 2. To boil them in water for a short while—have proved ineffectual. The best treatment has been suggested by Mr J. Walton, and is generally followed in England. It consists in strewing abundance of chlorite of lime over the potatoes. In this way they may be safely kept for next year's crop.

The influence of variety.—*Very early* kinds have completely escaped, and are fit to be preserved, for they were full grown before the fungus made its appearance. Among the late kinds some were more affected than others. It is worthy of remark that

one kind, received from England this year (1845,) and p in Gend in the beginning of May, has not been attacked; a kind, introduced by Lord Crewe, and grown in Liege, has totally escaped.

As regards the raising of potatoes from seed, Professor M remarks that this is a matter of great importance, and very able, provided the seed or apple be procured from 1 regions; for the reason why potatoes, equally long cult but more recently introduced than others, have better bee to resist the disease, is the manifestation of a more en vital action; and this greater energy was a necessary conse of the plant being transferred into another and better soil.

It is further a fact of experience, that the seeds of a pla be better able to produce varieties that will live and th their new native country, the more distant the country parent plant is. Instances are taken from the dahlia, wh innumerable varieties in Europe, but none in Mexico, its country; of the camellia, which is nearly of uniform appe in China and Japan, but of which numbers of varieties are in Europe, &c.

In case, however, the process of raising potatoes from s tried, it is of prime importance to select a proper soil for c tion; and also a sound and fertile fruit, duly prepared for gation, by allowing only two or three in each bunch to maturity, and cutting off the rest. When intended for u seed should be taken out of the fruit, and well washed, k only those which sink in the water, further dried in the su piece of paper, during twenty-four hours, and preserved c safe from the attack of insects. To get very early kin fruit or apples should be taken from the flowers that have ed their petals first.

It is also proved by experience that the potato prefers a climate to a dry one, and grows better at a moderate th high temperature. Peru, where it grows in a wild state, pr no potatoes that are edible, and at the same time yiel returns; it is in the North of America that they increase so in size and produce. In Ireland, of which the climate is and the temperature moderate, and in Lancashire, the culture reaches a high state of perfection in every respe in Italy, Spain, and the South of France, and part of Ge the produce is of inferior quality.

For these and other reasons, it is advisable to pay pa attention to the raising of winter potatoes; they are sa experience to suffer much less from disease than those ra summer. The potato, although it may be planted to a d

three feet without danger, should, however, be sown less deep — half a foot for instance.

Reference is made to the experiments made by Mr Goodiffe of Granard; by Mr Jackson in Manchester; to those of Mr Williamson, made in the island of Bute and in Perthshire; and of Mr Herry of Handsworth, to prove the advantage of raising early potatoes. Several growers in Germany and France have done the same with equal advantage.

The practice followed in Lancashire, of planting only the rose-end, and keeping the opposite part for food, is considered the best of all. As the eyes of the rose-end produce their shoots about three weeks earlier than those of the heel-end, this method is well calculated to grow early varieties.

As to the alleged causes of the disease—I mean the remote causes—many are of opinion, apparently with some ground, that these are to be looked for in a co-operation of several circumstances; others, again, have advanced that there was one circumstance that acted either chiefly or alone; others, confining themselves to a negative opinion, have believed that a certain circumstance was *not* the cause. Of this latter way of reasoning, we find an instance in Mons. de Gasparin, who, finding that of the two crops which are annually raised in the South of France, the spring crop suffered from no disease, although under a lower temperature than that prevailing during the growth of the summer crop, which suffered much, infers from this fact that the temperature had nothing to do with the disease. And if, on the other hand, we draw our attention to what appears to have been experienced in Scotland, according to a series of observations collected and brought into a tabular form by Mr Milne of Milnegraden, then it would appear that the average temperature of 1845, especially about the time that potatoes were ripening, was lower than in former years; and that there was a certain relation between the degree in which the disease prevailed in different districts, and the lowness of temperature in the same place.

We will, for variety's sake, quote here some passages taken from the well-known French chemist Payen, about the progress of the disease in the plant. He says, that the diseased part (in an advanced stage no doubt) appears to have lost all the starch, and that at the same time the protein compounds and the fat have entirely disappeared, which he considers as an effect of the fungus—for a fungus, he thinks, is the cause of the disease. He has succeeded, he says—although it is not stated by what means—in separating this fungus; and found, on analysing it, that,

after having subtracted the ash, and removed the adhering cells and starch, it contained exactly (!) as much nitrogen as was found by him in cultivated mushrooms. When the disease advances, the nitrogenous part is loosened from the internal cell-walls, and encloses the starch as in a little bag, which gradually splits and divides into several portions, each of them drawing along a globule of starch, and making it participate in their own decomposition. In this manner, the little portions of the little bags become thinner and thinner, and at last the cells are left entirely or nearly empty. We will make no comment upon this seemingly very illustrative representation.

Before finishing our present paper, we feel obliged to draw attention to the opinions of Mr Berkeley on this subject, as set forth by him in an elaborate article in the *Journal of the Horticultural Society*. He expresses his conviction that the grounds for considering a fungus as the cause of the disease, are more valuable than those advanced against this theory; and that the objections against the view which he and others take, are either overrated or not well understood. One of his chief grounds is, that the fungi, which are in relation to these species found upon diseased potatoes, do *not* generally feed upon decaying matter, but produce decay. It is further involved in this theory, that external circumstances, which are favourable for the production and growth of the potato, are unfavourable for those of its parasite, and *vice versa;* and this point establishes a relation between this kind of fungus-theory and a modification of it, viz.—that the seed of the fungus has not been transferred upon the plant, but is naturally inherent in the latter; an opinion advanced by Dr Greville in Scotland, and by Dr Cohen in Holland, the latter of whom had it published last year among other points on this subject.

There exist several other opinions, which we do not consider important enough specially to record. That of Liebig, about the conversion of albumen into the so-called casein, is disproved by analysis;* and those who consider the disease as a mere effect of oxidation by the agency of the air acting more freely upon the organic matter of the weakened cellwalls, do not certainly show

* The manner in which this has lately been disproved by Dr Ure, is certainly not the right one. It would appear that both he and Mons. Dumas are unacquainted with Mulder's celebrated discovery, that albumen, casein, fibrin, &c., when dissolved in an alkaline ley, are *all* in the same manner thrown down by the addition of acetic acid; but that the precipitate produced is no longer albumen, casein, fibrin, &c., but in every case the same body, viz. *protein*. It is only by taking the potato juice in its *natural* condition that we can judge of its real properties; and it is without submitting the potato to the action of an alkali, that we have found that what is called casein is equally present in sound as in diseased potatoes.

a very great amount of physiological knowledge, which requires that the progress of phenomena should be followed step by step, and which does not permit that the mentioning of final results, *even if they were correct*, should serve as an explanation. The liability of the incrusting matter to undergo decomposition, as stated by Mulder, and proved by my own investigations instituted in Utrecht, has been advanced in a former number of this Journal as a possible cause of the disease; but this, if at all probable, does not afford much explanation, and could scarcely serve to suggest means for recovery. The nature of the incrusting matter, and its relation to inorganic bases, are at present far too little known to found a theory upon their pretended action.

Before closing the present paper, however, we wish to make mention of one or two points of some importance, resulting from the microscopic observations of Messrs Van Baumhauer and Moleschott, in Utrecht. They found that the threads of fungi in diseased potato plants were the same in the whole plant; but that the sporules produced by the fungi had two different forms: the one entirely similar to that of the sporules of the *Fusisporium solani*; the other, more or less, to that of another variety, called *Sporotrichoides* by Von Martius. The *Fusisporium* existed in the greatest abundance, and in the highest stage of development, in the upper part of the stem and leaves. The lower they came, the more the number, and especially the stage of development of the fungi, decreased. Only once they found the fungus on a fibrilla, very close to the stem, *but never lower*. This appears to indicate the course which the disease has taken. They, however, most positively assert that they did not, in one single case, find even traces of fungi in or on the diseased potatoes that were recently dug out of the ground.

THE FARMERS' NOTE-BOOK.—NO. XII.

Manure. By Mr Towers.—To resume this subject at the point where I left in the October Number of 1845, p. 118, line 3, it will be requisite to take a glance at the nature of those constituents which, under the name of *inorganic* elements, have been subjects of much attention and dispute since the first edition of Liebig's *Organic Chemistry*.

There are many persons who not only adopted the great German's opinions to the letter, but who stoutly insisted upon a sort

of ultra theory, as I endeavoured to prove at page 112. However, not to dwell upon subjects which argument or theory can neither disprove nor establish, it will suffice in the present instance to prove by the result of direct experiment, that the *ashes of plants*, if treated fairly, and subjected to faithful analysis, will afford evidence demonstrative of those saline, earthy, and, of course, inorganic constituents, which they must individually and specifically obtain from the soil—but certainly not from the air—through the media of their leaves.

The fact I propose to adduce will not be direct or conclusive as to the quantity or quality of products obtained. The experiments were originally accidental; but this circumstance, so far from being inimical to the principle which I desire to establish, will tend rather to confer importance upon it, in so far that the processes and results show that evidence may be obtained from all, even the meanest of vegetable products; and, therefore, that men of analytic skill ought to bend every effort so "to put questions to nature," as to compel her to return clear and instructive answers.

Of *organic* analyses there is reason to hope that, not only in Scotland, but in England also, we shall speedily receive correct information—the noble College of Chemistry, recently founded, and, as it now appears, rapidly progressing, having given assurance that greater encouragement should be afforded than hitherto to the study of organic chemistry; while it invites members "to forward specimens of soils, minerals, vegetable productions, and all other substances, that the advanced students may take them up for investigation."

Results of great value must be obtained, and be reported, if these intentions be faithfully carried out; but, in the meantime, it behoves every one who shall have obtained certain evidence of any important truth, to lay it before the public, that, in this day of active research, persons competent to undertake *qualitative* analyses may investigate the subject, and extend inquiries of a like nature, till at length we attain to a certain knowledge of fixed principles, which can neither be misunderstood nor controverted.

While consuming the refuse of the garden last October, it occurred that an opportunity was presented to try the results of combustion on a mass so heterogeneous as that of garden refuse—weeds, cabbage and lettuce-stalks, old raspberry canes, artichoke stems and decaying leaves, *cum multis aliis*.

From the heap of gray-ash, a portion of the cleanest was selected, and a drachm of it by weight (60 grains) was digested in a little water for twenty-four hours, then slightly heated, strained,

and washed on the filtering paper till the drops fell devoid of taste. The first test was a strip of turmuric paper, which instantly was reddened, evincing a powerful alkaline reaction.

The fluid was then divided into three portions:—1. One was evaporated to dryness; and, as it contained the saline ingredients of 20 grains of the dry ash, the yield of 2 grains by evaporation proved that salts, to the extent of a nineteenth part of the ash, had been eliminated by fire. Here then we discover a large proportion of very active saline matter, which claims to rank among the most important of *inorganic* manures.

But what were these salts? An alkali predominated; and as the 2 grains obtained in a dry state gradually attracted moisture, the presence of free *potassa* was at least suspected.

2. The second portion of filtrated liquor, acidulated by a drop or two of nitric acid, to prevent alkaline reaction, was treated with nitrate of *baryta*, and a manifest deposition of sulphate was the result; hence sulphuric acid became manifest, combined most likely with potassa.

3. After separation of this precipitate, the clear liquid which passed the filter yielded to *nitrate* of silver a sensible quantity of muriate of silver; therefore *muriatic* acid must have existed in the salts, combined with soda. No phosphate was traceable, nor any calculable quantity of lime, but there was a faint trace of iron.

4. The dry *insoluble ash* was treated in two ways;—first, by hydrochloric acid and long cohobation, whereby some iron was dissolved, which was detected by *ferro-cyanuret* of potassium. The effervescence created by the acid gave above 3 grains of carbonic acid, equivalent to $3\frac{8}{10}$ths of lime. The insoluble matter thus left, being 20 grains, was fixed with mild alkali, then treated with nitric acid, redissolved, filtrated, washed, and forced to yield 22 grains of fine silex; the clear fluid, when passed the filter, gave to prussiate of potassa a very great precipitate of Prussian blue, equivalent to $2\frac{1}{2}$ grains of oxide of iron; and to pure ammonia it yielded about 1 grain of pure alumina. Chloride of platinum had also established the presence of potassa in the soluble salts. These, and similar qualitative "questions," put by means of re-agents, evinced, to a great extent, what a second trial by nitric acid, as the cohobating solvent, subsequently confirmed; and thereby, though an accident interfered, the ashes of garden refuse were found to contain sulphate of potassa, with excess of the alkali, muriate of soda, carbonate of lime, oxide of iron, a little alumina, a very faint trace of magnesia, and abundance of silex, a portion of which, not acted on by the acid, was proved to exist in the form of a *silicate* of iron and alumina.

The deductions we arrived at from two or three analyses of matters so humble and debased, are these:—If from such substances we obtain decisive evidence of the existence of very consequential inorganic elements, what value ought not to be attached to more close and minute investigations of the higher order of vegetables; and how much reason is there to conclude, that, by such analyses, we shall attain to certain and definite principles of culture?

Here, however, we are checked by the singular, but much more startling announcement, of a system, or series of evidences, which had attracted some attention in the article of October last. At that time we had read of a discovery said to have been made by a Mr Bickes, of the possibility of growing corn without manure, and which he was then taking steps to confirm, and render apparent to the cultivators of the soil. There the matter rested, and till the beginning of the present year the subject was not revived.

Then, however, attention was roused by the publicity given, in several agricultural journals, to circumstances which claim profound investigation. In one day three newspapers came to hand which contained very minute statements of what were averred to be accredited facts. It becomes, therefore, a duty to lay before the readers every thing that has been announced; but I prefer to select that authority which claims to be founded upon actual observation, and therefore extract from the Gardener's Gazette of Saturday, January 17, the following particulars. They are headed,—*Mr Bicke's Extraordinary Discovery—Growing Corn without Manure.*

"We attended a meeting on Saturday last, for the purpose of hearing an explanation of the system by which, as was alleged in a prospectus, corn can be grown on land considered barren, or nearly so, and of seeing specimens of the produce; and, to say the very least, our astonishment was greatly excited. To say that the secret by which the result has been obtained (which to our finite understanding was impossible) is invaluable, is to say very little, for if accredited documents, certifying that the samples exhibited were really grown on moving sand, in some instances, or gravel in others, and on wretchedly poor land in all, and without the slightest dressing or manuring, were not astounding, we know not what is so.

"Mr Bickes declares that he can, by simply preparing the seed, cause grain to perfect itself in ground which it was too poor to cultivate at all by the ordinary means, and that he is willing to prepare seed for any one who may wish to try it, and put his powers to the test. The samples are at the office of Mr Croucher, in Trafalgar Square, and we strongly urge all who take the slightest interest in such matters to call and judge for themselves.

"Mr Bickes will prepare any seed, no matter whether for the garden or farm, and sow it himself, at any distance, so that his travelling expenses, &c., be paid, and that very moderately. He declares that the expense on a large scale is not more than a few shillings per acre, and that the effect is a much more abundant crop on good land, and an ordinary crop on land which had a bad crop before.

Unfortunately the greater part of the specimens were gathered, or rather drawn—for the roots are on the plants—in the month of June, when he left for England; the consequence of which is, that the grain is not, in some of the cases, full; but there are enough with perfected seed to settle all manner of doubt as to the probable result of that gathered unripe; and we believe that, by this time, he is on the Continent, for the purpose of producing ripened grain from the same fields, properly authenticated. Next week we shall publish the whole of the certificates. Mr Bickes commits himself to every body without gaining a shilling, and only seeks an opportunity of proving his powers even before he will offer his secret for sale. This secret is certainly in the preparation of the seed by steeping, but its effects so far outshine all that has been boasted, to say nothing of accomplished, by others who have practised steeping, that we are bound to accord to him the possession of a knowledge, which none that we have heard of pretends to have acquired, even if we give credit to their most extravagant pretensions."

So much from the testimony of an eye-witness. The following evidences are obtained from the *United Gardeners' and Land Stewards' Journal*:—

"Mr Bickes has been engaged for sixteen years in agricultural pursuits in his native country. It was stated that the value of his discovery was fully attested by practice. The gentlemen present were here supplied with a copy of testimonials from various parts of the Continent, as well as England, which he now produced to the public." Among them he enumerated those of several landed proprietors in Belgium—that of Colonel Blagrove of Calcot Park, Berks—and of other gentlemen in that county, who had tried the prepared seed; and, likewise, it was stated that experiments were in a course of progress in Herts; so that altogether about 300 acres were either sown, or prepared to receive the seed.

"A great number of specimens were handed about the room, consisting of wheat, barley, oats, maize, and various kinds of shrubs and plants. The cerealian products especially were of the most gigantic dimensions; yet it was stated these were grown on inferior land, without manure, the seed being simply prepared; notwithstanding which they had arrived at maturity much earlier than the best favoured grain under the ordinary system of cultivation. A very fine *rose-tree* was shown, grown from *prepared seed*, which in *one year had become as large as it ordinarily does in eight.*"

With these preliminaries—for such only they are—it remains to consider what would be the results to British agriculture, were the system fully established by positive experiment. A blessing more devoutly to be hoped for, than that of more abundant, earlier harvested crops, can scarcely be imagined; but what, if poor miserable land, without manure, is, by a mere process of steeping, to have its powers of supply so exalted, as to surpass those of our now richest loams—what, I ask, is to become of those masses of manure, however created or accumulated, which, were they not

deposited within the ground, would convert its surface into an aceldama, and every farm-steading into an area of pestilence?

It is a forestalling of facts, thus to anticipate what may never be realised; yet it were wise to be prepared; for if accounts be true, there are many breadths of land at no great distance from the metropolis already sown with seed prepared by Mr Bickes, and thus in a state of progress. Should these trials prove successful, a period of less than six months may suffice to change the whole theory and practice of agriculture. In the meantime, while remaining perfectly quiescent as to doubt, expectation, or hope, it will be the duty of every farmer to keep on the alert, to look out for himself; or, if too remote from the field of inquiry, to request the assistance of those near at hand, to investigate and report.

When Mr Campbell first announced *his* "steeps," I found almost all the farmers near me cold and apathetic to the last degree. With one person, who condescended to try half an acre, the application succeeded beyond a doubt; but there an end.

Now, however, farmers may be ready to be a little more on the alert. A double crop would be a fine thing; and then, with the poet, they might justly exclaim—

"Tempora mutantur, et nos mutamur ab illis."

I conclude this imperfect notice by extracting from the *Gardeners' Gazette* of the 24th January, so much of the testimonials as, at the present moment, refer to England. The whole of the certificates occupy nine entire columns of the paper; they are introduced by a letter addressed to the agriculturists of Great Britain, dated 10th December 1845, from Mr Joseph Croucher.

The following passages are found in that letter, and ought not to be passed over:—"One great and incessant demand on the farmer's pocket is the cost of manure, however good his land may be. There is a very large quantity of land lying around him not worth cultivation, because the manure required would be too costly for him to attempt to cultivate it; therefore it remains waste, or fetches a nominal rental." The certificates refer to practical results extending over sixteen years, from 1829.

Certificates, Nos. 27 and 28, are found in two letters by Colonel Blagrove of Calcot Park, Berks—the first to the editor of the *Reading Mercury*, announcing the visit of Mr Bickes to the Colonel on the 21st of July last, and the results of experiments then made with prepared wheat, flax, turnips, vetches, rape, and potatoes, all sown without manure upon land of very indifferent quality. "The two first," it is stated, "are most abundant, *and*

would have been ripe had it not been for the cold weather;" date September 24, 1845.

The second is to Mr Bickes, on the 25th of the same month, ordering prepared wheat, sufficient for four acres; naming the red chaff as most hardy, and least likely to fail on the land intended for it; adding, "if you can produce a crop on that land without manure, it will be nigh to a miracle."

No. 29 is a letter dated Hamsteadbury, Redburn, Herts, September 28, 1845, from Mr T. W. Overman to Mr Bickes. It states the writer's desire to "extend the knowledge of the discovery," and requests the preparation of sufficient seed for the coming seed-time. In conformity thereto, 250 acres have been sown with prepared wheat on the lands near Redburn, besides those of others on the list—all on the 3d and 7th of October.

On Mr Overman's land, 96 acres.
On Mr Overman's land, Houlden, Bedfordshire, 40 acres.
On Mr Samuel Pocock's land, King's Langley, near Hemel Hemstead, 33 acres.
On Mr Shadrock Goden's land, Grovehill, near ditto, 30 acres.
On Mr John Bates' land, Harpendenbury, near St Alban's, 33 acres.
On Mr Thomas Oakley's land, Kingsbury, near ditto, 115 acres.
On Mr John Stephens' land, Fish Street, St Alban's, 25 acres.
On Mr G. Webb's land, Beaumonthill, Redburn, 25 acres.
On Mr John Parrott's land, steward to the Earl of Verulam.
On Mr Muir's farm, Gorhambury, St Alban's, 40 acres.
On Mr Earnest Dixon's farm, Redburn, 10 acres.
On Mr Frederick Gough's farm, Cunningham Hill, St Alban's, 10 acres.
On Mr Edward Lewis's farm, Heatingfordbury, near Hertford, 10 acres.

Finally, on the 27th November, on the farm of Mr John Culley, Cassey, near Norwich, "eight bushels of prepared wheat, and two bushels of the same unprepared—these wait the result of the harvest of 1846."

The foregoing was written some months since, at a period when the subject was fresh to the public. Circumstances, however, prevented its insertion at the time. In the absence, therefore, of the conclusive evidence that may result from the experiments thus in progress, we will solicit attention to others of an opposing nature, the very converse of the theory of cultivation *without* manure.

I have already endeavoured to establish the self-evident proposition, that manures must be produced, and as certainly be committed to the earth, whence renewed vitality will spring from the decaying residue of dead matter; and now we are favoured with a communication of an *experiment of raising a large crop of Swedes upon barren land*, by means of artificial manure.

This appears in Vol. vi., Part 2, of the *Royal Agricultural Journal*, commencing at page 355, addressed by the Reverend A.

Huxtable to the President, Lord Portman, from Sutton Waldron, per date Nov. 11, 1845.

Liebig taught the agricultural world—that part of it at least which would condescend to listen to the suggestions of a scientific chemist—that, by faithful experiments upon the ashes of vegetable bodies, many correct ideas bearing upon, and elucidating the philosophy of cultivation, would be obtained.

We begin to *feel* this truth; and many recent articles in farming periodicals prove that it is working its way, and, as usual, prevailing against error and prejudice.

The reverend writer says—the problem which I sought to solve is contained in the question—"Can we, by supplying to the soil the constituents (so far as at present known) of a plant, cultivate that plant on any land, however in itself sterile?"

The precise spot selected was a hill, situated on the barren district of Cranbourn-Chase, Dorset. It appeared the most barren and unlikely of the neighbourhood. The labourers employed found it too shallow and stubborn for the spade; they therefore "knocked it over with the pick-axe."

This land was subsequently sown twice with rape, but produced nothing, and therefore was deemed a fair field for the experiment in a *popular way*—such as would show that, on land growing nothing, a large crop might be obtained by means pointed out as necessary, on *chemical principles*. "Accordingly," to adopt Mr Huxtable's own words, "in the latter part of April 1845, I determined, on this hill above described, to see whether it were possible to produce a crop of Swedes weighing 20 tons per acre. To effect this object, chemical analysis, as given in Professor Johnston's lectures, acquaints us, that there would be required for the bulbs and tops of such a return (*i. e.* for 20 tons of bulbs and 5½ tons tops) inorganic matter weighing more than 500 lbs.; consisting of about 146 lbs. of potash, 76 lbs. of soda, 69 lbs. of sulphuric acid, 30 lbs. of phosphoric acid, 103 lbs. of lime, 22 lbs. of magnesia, 23 lbs. of chlorine, 23 lbs. silica, as well as a certain proportion of organic matters, in the form of ammonia and carbonic acid."

As it is not intended to enter upon any regular detail of the experiments, I only adduce so much of the writer's article as will convey a clear idea of the effects produced by the chemical manures employed by him; therefore, little more will be required than a table of the substances introduced into every acre of the land, and the cost of the whole, premising—as we might naturally expect—that "the men employed" on the experiment, "and every eye-witness who passed by, smiled incredulously at what appeared at the time an act of well-meant folly."

Thus stands the cost per acre:—

30 bushels of wood-ashes, at 6d.,	L.0	15	0
2 cwt. of Ichaboe guano, at 7s. 6d.,	0	15	0
50 lbs. of burnt bones, and 22 lbs. of sulphuric acid,	0	7	0
30 bushels sawdust,	0	2	6
Labour account in hoeing, drill dropping seed, (the surface of the land being otherwise untouched,)	0	19	6
10 lbs. of sulphuric acid, poured over ashes,	0	1	3
Rent 5s.; rates, &c. 2s.,	0	7	0
Seed, 2 lb. per acre, 1s. 9d.,	0	3	6
A pair of horses, hauling the artificial manure to the summit of the hill,	0	7	0
	L.3	17	9

Other charges for a previous labouring of the land have been deemed by some as justly chargable; but Mr Huxtable asserts, that he has given every item of cost that can be laid against the result—which was 21 *tons of Swedes per acre;* and he adds, "Therefore, I do not hesitate to express an opinion, that, to persons who know how to use *Swedes*, they are worth L.15, 15s. per acre, at a cost of L.3 : 17 : 9, giving a return of more than 300 per cent for the outlay."

In a paper published last February, in Vol. xxiv., *old series*, No. 2, p. 170, of the *Farmers' Magazine*, headed, "A Visit to the Farms of the Reverend A. Huxtable," we have ample confirmation of all that is stated in the Royal Journal first referred to. This is most gratifying; and from this paper I select the few following lines only, amply satisfactory, as they are characteristic:—"We walked over it," (the barren hill,) "and were as much surprised at the enormous dimensions of the turnips as at the stony, barren-looking soil on which they grew. From this land 21 tons of Swedes per acre have been obtained; and, in proof of Mr Huxtable's assertion, that he could grow a crop in a hole cut in a table, we may mention, that we saw some of his finest turnips growing in a hedge-furrow, from whence the little quantity of soil originally found had been thrown to form a bank. Thus, on flints and chalk, (for those were all that could be observed,) was grown a sample of turnips that might challenge the produce of the richest lands in the county."

Little remains to be advanced. We have stated some of the voluminous testimonials of results already said to have been obtained, by processes of steeping the seeds of grain and fodder plants; the land being naturally poor, and remaining so at the time of sowing, since no manure was given to it.

As a converse, the results of a trial with chemical inorganic substances, are affirmed and substantiated by credible authority. Evidence equally strong might be brought forward in favour of sound guano.

In reference to the turnip crop, I saw, in Hanover Square, in July 1844, young plants raised by Lord Essex, so fine, large, and luxuriant, when compared with some others, that no one could hesitate to pronounce them super-excellent; and this luxuriance was said to be produced solely by the application of charcoal dust, in the drills, with the seed. *How* could this insoluble matter act? And yet, I myself produced in my own field a corresponding effect, by a very trifling addition of the same inert material. The absorbent ammonia-attracting quality of the charcoal presents the most plausible answer; but such was the fact, account for it how one may.

It is plain, then, that we have much to learn, much to admit; a rapidly increasing development of science, abundance of means and resources; and thus, with the exercise of skill and industry, and a judgment ready to reject old prejudices, we may reasonably hope to double the productiveness of the land.

*Notes on making Cheshire Cheese.**—On a moderate calculation, 12,000 tons of cheese are made in Cheshire annually. The milk, from which cheese is made, consists of three parts—cream, whey, and curd, into which, by repose, it spontaneously separates; but the separation of the whey from the other constituents is accelerated by the addition of a small quantity of a simple acid, which is obtained from cured and dried maw-skins† by macerating them in warm water. This infusion is called Steep or Rennet.

Cheese-making comprises the complete extraction of the whey, and the proper compacting and curing of the curd. Richness

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* From a prize essay, by Mr Henry White, land agent and surveyor, Warrington, containing a detailed account of the making of Cheshire cheese, and published in Part I. vol. vi. of the *Journal of the Royal Agricultural Society of England.*

There is reason, we believe, for supposing that, while in Scotland the materials for making cheese are not inferior to those in England, the cheese manufactured in Scotland is in general not equal, in quality, to that made in England, and that, in practice, it has been found advantageous to attend closely to the process observed in England. We are, therefore, induced to present to our readers, and more especially to those among them who are interested in the caseous products of the dairy, the following digest of an intelligent essay, describing in detail the method of cheese-making in Cheshire.—Editor.

† *Recipe for curing maw-skins.*—Procure fresh skins the year before they are wanted; free them from chyle and every impurity; turn them inside out, and salt them; lay them one upon another, with salt between, in a deep earthenware vessel; cover the whole over with salt, and lay a lid on the top. About a month before using them, take them out and drain the brine from them; then spread them on a table, and powder them on each side with fine salt. In this state, they are to be rolled with a paste roller, distended with splints of wood, and hung up to dry.

depends upon the cream; and, in Cheshire, cheese is professedly made from full milk, though, in different dairies, a little cream is skimmed off.

Number of cows kept, and produce.—The number of cows belonging to a cheese-dairy is seldom less than 8 or 10, or more than 70 or 80. From 18 cows, a cheese from 36 to 54 lbs. weight is made daily during four or five months of the summer. The annual produce of cheese varies with the quality of the cows, the mode of keeping them, and the nature of the herbage; and great loss is known to have been sustained by not feeding the animals sufficiently in winter.

*Calving.**—It is customary to arrange so that the cows may calve in March or April; and, as soon as the calves are fed or disposed of, the cheese-making begins, and continues, except in small dairies, nearly to the end of the year.

Milking.—The operation commences about five o'clock in the morning, and five or six o'clock in the evening. It is performed in cow-houses all the year; and it is usual to have a milker to every six or seven cows. The milk of newly calved cows is not mixed with that of other cows till four or five days after calving.

Offices and Utensils.—The evening's milk is seldom made into cheese till the following morning, and, in small dairies, sometimes not till the second morning. A cool milk-house is necessary; and hence it is commonly found on the side of the farm-house least exposed to the sun. The milk is usually kept in portable, shallow earthenware vessels; but, in some dairies, zinc† or leaden‡ coolers are used.

Most milk-rooms have lattice or wire-windows for the circulation of air, and an inclination is given to the floors for the free escape of the cold water which is daily applied to them in summer. Precautions of this kind are necessary to prevent the milk becoming sour. A temperature of 50° of Fahrenheit is thought the best

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* *Gestation of cows.*—From observations of the late Earl Speuser on the period of gestation of 764 cows, it appears that the term extends to 284 days.—*Journal of Agriculture.*

† *Zinc vessels.*—Such vessels are certain, after a short time, when the milk and pans sour, to hold a considerable portion of zinc and its salts in solution; and it is well known that even a small quantity of zinc will cause violent spasmodic vomitings.—*Journal of Agriculture.*

‡ *Leaden coolers.*—Lead, when exposed to the action of air and moisture, is rapidly corroded . . . . forming a white crust of carbonate, which is highly poisonous.—*Gregory's Outlines of Chemistry.*

throughout the year. The dairy is generally near the milk-house, and fitted with two boilers; one for scalding whey, and another, less in size, for heating water. The salting and drying house should adjoin the dairy. Here the cheeses are placed on stone or wooden benches, salted externally, and dried gradually before removal to the cheese-room. Some dairymaids dispense with external salting. Sometimes the cheese-room is over the dairy; and, at others, it is over the kitchen, or other apartment in which a fire is kept. Light and air are always excluded from it by a curtain or shutters; and one reason assigned for the practice, is its tendency to prevent the hurtful effects of the fly. Some of the larger cheese-rooms are warmed by stoves or hot air, and, in rare instances, from ordinary fireplaces built in them. If the cheese-rooms become too warm in summer, the cheeses need to be removed to cooler places.

Process of Cheese-making.—The extraction of the whey and salting occupy from five to seven hours, and it is therefore convenient to commence work in the morning. In this case, the evening's milk is kept over night; and, in the morning, the cream is skimmed off, and a portion of the milk warmed. The warming is effected by means of a brass or tin-pan, about 20 inches in diameter, and 8 inches deep, in which the milk is floated in the boiler, the water in which has been heated for the purpose. In the early months of the season, so much as half the evening's milk may be heated to a temperature of 100° of Fahrenheit, a heat seldom exceeded, except with the view of saving trouble in the after-process. The cold milk is now poured into the cheese-tub, and the warm added to it. The temperature of the mixture may be about 75°; but, in warm weather, 70° will be enough. It is, however, becoming the general practice, in summer, not to warm the evening's milk; and, in very warm weather, even the temperature of the morning's milk is sometimes reduced. The cream, diluted in about double its quantity of warm or new milk, is next put in. If a small portion of the cream is to be retained for butter, it is thought best to skim it off the whole surface of the cream before diluting, in order to remove froth and bubbles, which are considered prejudicial to the cheese. This leads to the conclusion that fixed air in the curd is detrimental; and suggests the inquiry, whether it might not be better to heat the whole of the evening's milk to the required temperature, than to raise the temperature of a part of it to 100°. The next step is to add the new or morning's milk, which is done by passing it through a sieve placed on the cheese-ladder over the cheese-tub. Bubbles seen

floating on the surface are skimmed off, and passed through the sieve to break them.

An important point, now demanding attention, is the proper temperature of the milk when the rennet is to be put in. Little is known among farmers and dairy-maids as to the precise heat which is best; and it is seldom that the temperature is tested otherwise than by the hand. In some dairies in which observations were made, the lowest heat was 77°. Even where what is called cold-cheese, which has a tendency to green mould, is made, it is not supposed that a temperature is adopted, at any season, much under 74° or 75°. The evening's milk being about 75°, and the morning's milk from 90° to 95°; the temperature of the whole is found to be from 80° to 85°. The exact heat at which milk ought to be coagulated is a matter of essential importance in cheese-making, and it can only be ascertained by a series of careful and judicious experiments, made by scientific and practical parties.

The rennet or steep is now to be added. To fix the quantity requisite for coagulating a given measure of milk is difficult, as maw-skins vary much in quality. In using them, two skins are often cut at once. Three square inches taken from the bottom or strongest part of the one, and one or two inches from the top or weakest part of the other, are generally sufficient for 60 gallons of milk. These pieces are put into a cup containing about half a pint of luke-warm water, with a tea-spoonful of salt, the day before the infusion is required. The water thus impregnated with the maw-skin is passed through a sieve into the milk; but the skin itself is usually kept out,—the rennet cup is well scalded before being used again. The colouring matter * and rennet having been put in, the milk is well stirred, and left to coagulate; and the tub is covered up. The coagulation is commonly effected in an hour or an hour and a half. The warmer the milk, or stronger the rennet, the sooner coagulation ensues; but the curd is tougher and less in quantity; on the contrary, the cooler the milk, or weaker the rennet, the longer is the curd in forming, but it is both more tender and there is more of it. Too much rennet tends to impart an unpleasant flavour or bitterness to the cheese.

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* *Colouring Matter.*—The substance which ought to be used as colouring matter is Annatto, the produce of *Bixa Orellana* of Linnæus. The article chiefly used, however, is manufactured in this country. It imparts to the cheese an amber or cream-like appearance. It is seldom employed when the cheese is for consumption in the families of the Cheshire farmers; for it is known not only that it does not improve the flavour, but that if the quality is inferior, or, if there is too much of it, there is a hazard of the flavour being much deteriorated. One pound of it to a ton of cheese, or half an ounce to seventy-five pounds, may be considered a moderate proportion.

It may generally be expected that the heat of the curd, when formed, will be four or five degrees less than the milk was when the rennet was applied; and the difference, especially in cool weather, should not be greater. To determine when the curd is fit for "breaking," requires some practical knowledge. It is usually done by gently pressing the surface of the milk with the back of the hand, or by lifting up the skimming dish, beneath which the curd and whey will distinctly appear if the coagulation is complete. Another criterion is the colour of the whey, which should be pale green.

The breaking and gathering of the curd next engage attention. These operations are performed by the hands and skimming dish, or more commonly the curd-breaker. This implement is made of wire-work, in an oval form, and has a rim of tin round it, about an inch and a half broad. It cuts the curd by being passed through it perpendicularly, and at first *very, very* gently, in different sections, so that the whole mass is separated into very small portions. For a 60 lb. cheese, this operation takes twenty or twenty-five minutes. The curd is then left for a quarter of an hour to separate from the whey, and, if the weather is cool, a cover is put over the tub to retain the heat. After the separation of the curd, which falls to the bottom, a portion of the whey at the top is taken out by the portable brass or tin pan being pressed into it, and emptied into the set-pan; the curd is then gently broken, by being raised with the hands to the surface, or by the renewed use of the curd-breaker. When the curd is brought to the top, it is easily seized, and separated into small portions for the release of the whey. This part of the process takes about half an hour. After about another half hour, or as soon as the curd is sufficiently settled, more whey is taken out, and the curd, so far as its contexture will admit, drawn into one half of the bottom of the tub; a semi-circular board is then placed on the curd, loaded with a weight of about 30 lbs. The board is perforated with holes about half an inch in diameter, for the escape of the whey. The tub is now set three or four inches atilt, to facilitate the discharge of the whey from the curd, and the skimming dish is used to lade it out. On its way to the set-pan, the whey passes through a sieve, in which any curd contained in it is collected. This curd is called slip-curd, and by some dairy-maids is not returned to the tub. The weight and board are shortly removed, and such part of the curd as has been squeezed from under them is again collected on one side, and a heavier weight of 50 or 60 lbs. applied as before. As the whey is expelled from the curd, it is removed. In a quarter of an hour the board is taken off again, the curd cut by intersections six or eight inches apart, and then the board replaced,

doubly loaded. Sometimes the slip-curd is now added, the weight is again increased, if necessary; care being taken to augment the pressure gradually, and to regulate it by the degree of compactness of the curd; for, if caution is not used in this respect, both now and afterwards, a considerable portion of butyraceous matter will be forced out, to the detriment of the cheese.

The curd is again cut into square pieces, taken out of the cheese-tub, and broken a little by the hands as it is passed into the "thrusting-tub." Sometimes a large sized cheese-vat, and at others a willow-basket, is substituted for the thrusting-tub. In this, the further extraction of the whey is continued by the application of "the screw," of which there are different kinds, but the principle is the same in all. Preference, however, seems due to the "lever press," which possesses the advantages of sinking by its own weight, and of allowing the application gradually of any degree of pressure, with less attention on the part of the dairy-maid. The thrusting-tub is round, with holes in the sides and bottom for the escape of the whey. A cheese-cloth of the coarsest kind is placed in the tub before the curd is put in. A "sinker," or strong circular board, which fits the inside of the tub, is then introduced a-top, upon which the screw or lever press is let down, and the power gradually applied. Long iron skewers are also thrust through the holes in the tub with their points upwards, and after five or ten minutes withdrawn, when they are followed by a flow of whey. The pressure is continued a little longer. The curd is now cut through with a dull knife, at distances of two or three inches; and the edge of the curd is cut off all round, and placed in the centre. The pressure is then renewed, and gradually increased, and the skewers are again introduced, and at the end of fifteen or twenty minutes drawn out. The curd is then taken wholly out of the tub, cut into four or five pieces, and each piece broken with the hands into portions of the size of two or three cubic inches. A clean dry cloth is made use of, the curd is folded in it, and pressure and skewering are again resorted to. These operations continue till the whey is sufficiently extracted for the salting of the curd, which comes next in order.

If the milk is "set together" at six o'clock, and the coagulation is effected in an hour and a quarter, the breaking, gathering, and preparation for salting, are generally accomplished by eleven or twelve o'clock. In some dairies, it is thought, the salting takes place when there is too much whey in the curd.

The proportion of salt is not regulated by any definite rule. One farmer, distinguished for improvements in agriculture, uses 1 lb. to 42 lbs. of curd. In another instance, more salt is used

in summer than at other times—the average being 1 lb. for 40 lbs. of dried cheese, or about 40 gallons of milk. In autumn there is always more curd in the milk than at other seasons; and, in wet weather, there is sometimes an increase of milk, without a corresponding augmentation of curd. Before applying the salt, the curd is cut into three or four equal parts, and these are broken into smaller pieces by the hands or curd-mill. The salt is then strewed over it, and the breaking continued till the salt is well intermixed, and the curd completely crumbled. Each portion, as it is broken, is put into the cheese-vat, in which a clean cloth, rather finer than the one used in the previous process, has been placed, and the curd is compacted by the hands as much as possible. The curd is allowed to rise two inches at least above the edge of the vat, and it is rounded a little in the middle. The cloth is then brought over it, and tucked in at the side of the vat with a small wooden knife. A tin or zinc hoop, or "fillet," with rounded edges, and ends unattached and lapping over, is used to support the curd protruding above the vat, and it is inserted round the inside of the top. It is pierced with small holes, and it sinks with the curd.

The vat is placed again under the screw or lever press, and the skewering repeated. The pressure is increased at intervals, and the skewers inserted in fresh places to hasten the discharge of the remaining whey, which is now termed "thrustings."

In the course of an hour from the time of salting, the curd is taken from under the screw or lever press, and out of the vat, and laid on a table. The angles of the side that was topmost in the vat are cut off, a circular piece, two or three inches deep, is often scooped out of the centre, and the whole are broken small, and rounded up in the middle. The cloth being drawn over the curd, the vat is turned down upon it; and then turning up the vat with the curd in it, the other angles and centre of the curd are similarly broken; after which the "fillet" is put on, and the screw or press applied for about half an hour or an hour. Where the lever press is employed, all the change which will now be required, is a little more weight at the end of the lever. Before turning the cheese to place it under the press, it is usual to pierce it perpendicularly with a skewer in several places, to form drains for the whey when turned. A clean cloth is applied, and a pressure of 6, 8, or 10 cwt., according to the size of the cheese, will be sufficient; this is generally accomplished by two or three o'clock in the afternoon. Smaller skewers are now used, changing their places occasionally, till about four o'clock, when they are removed; but the cheese remains half an hour longer without disturbance [illegible] discharge [illegible] whey. Then, or in

the evening, it is turned, a clean cloth put over it, and the pressing continued.

On the second day, the cheese is generally turned two or three times; it is also skewered, and a clean cloth is used each time of turning. The presses employed for the two first days at least, and, if possible, during the whole process, should be within the influence of moderate heat; otherwise the discharge of the whey will be retarded, and the greater hazard incurred of the flavour of the cheese being injured by acidity, to which the whey is prone. On the third day, the cheese is again turned once or twice, but it ought not to require any skewering. The heaviest press is now resorted to; and, for a cheese of 60 or 70 lbs. weight, a pressure of 30 cwts. will be enough. On the fourth day, it is usual to discontinue the pressure; but it is sometimes continued a day or two longer.

Salting and Drying Room.—There are sometimes separate apartments for salting and drying, but generally one room answers for both purposes. The salt can now be applied externally only, and if any good is done by it, the effect must be in the hardening of the coat of the cheese.

It may be questioned whether it would not be a better plan to remove the cheese direct from the press to the cheese-room. The practice of external salting, however, is commonly observed. The cheese is taken out of the vat, and a strong bandage about two inches broad, and long enough to go three times round the cheese, is put upon it with salt underneath. It is fastened with strong pins, the cheese is placed on a stone or wooden shelf or bench, and salt spread on the top to within an inch or two of the edge. The cheese is turned daily, and fresh salt and a clean bandage are as often applied. Some persons continue this salting five or six days, others three weeks. The salting being completed, the cheese is well wiped or washed, a fresh bandage is put round it, and it is laid on a wooden shelf in the same room, or an adjoining one, for the purpose of being dried. It is turned once a-day, and, when considered sufficiently dry, it is removed to the cheese-room. The time for keeping the cheese in the drying-room varies from seven to twenty days, and depends on the temperature of the weather, or of the cheese-room to which it is next to be taken. In hot weather, and particularly if the cheese-room is exposed to the heat of the mid-day sun, the change from a too cold drying-house is apt to cause cracks in the cheese. If these are left open, mites are soon generated, and the appearance of the cheese is hurt. In consequence, whey butter is sometimes used to fill

them up. To prevent cracking, the windows of the salting and drying rooms are rarely, if ever, opened. The same is the case in the cheese-room, from which, in addition, the light is excluded. The heat of drying-rooms, it is thought, should range from 50° to 60° Fahrenheit.

When a cheese is taken to the cheese-room, it is usual to scrape and clean its exterior, and to place it, at first, in the coolest part of the room, often for a few weeks upon a shelf or bench, which is cooller than the floor, subsequently on the coolest part of the floor, and finally upon the warmest part. The bandage is continued for several weeks, and sometimes until the cheese is sold. The cheese is turned and wiped daily for three or four months at least, and afterwards every alternate day. The floor of the cheese-room is generally covered with dried rushes or wheat straw. It should be level, and well washed with hot water and soft soap twice or thrice a-year. The temperature should be from 60° to 65° Fahrenheit.

The industry, cleanliness, and frugality of the Cheshire dairymaids are worthy of admiration. Their labours are great, and their cleanliness not to be surpassed; and it is often to their good management that landlords are indebted for the payment of their rents.

Pigs. By JAMES H. FENNELL, author of "A Natural History of British Quadrupeds."—Among our ancestors the hog was a very important animal. When we reflect that even in the great men's castles the people subsisted chiefly upon salted meat during winter, we perceive the value of the privilege of feeding hogs in the royal forests granted by the great forest-charter of Henry III. In *Doomsday Book*, which is an account of the various land estates in England shortly after the Conquest, we find an Anglo-Saxon nobleman bequeathing 2000 swine to his two daughters, and 200 to two priests. At that time the forests were only specifically valued as they afforded pasturage to a certain number of pigs, which fed on the mast* and acorns to be found there, and were watched and guarded by swineherds, who were then more numerous than shepherds now. Fitzstephen, in his *Description of London*, written in the latter part of the twelfth century, mentions boars among the wild animals which frequented the forest that at that time surrounded the city. Muckross, the ancient name of a tract of country now forming one of the extremities of the

* Bacon is supposed to derive its name from the circumstance of the animal feeding most usually in England upon beech-mast, which in the Anglo-Saxon is called [illegible]

county of Fife, signifies, in Celtic, the boar promontory: and that locality, according to tradition, was famous as a haunt for boars. A district forming a portion of it is called, in old writings, the Boar Hills, now corrupted into Byre Hills. It lies in the vicinity of St Andrews, in the cathedral church of which city it is said that there were to be seen, before the Reformation, attached by chains to the high altar, two tusks of the extraordinary length of sixteen inches each, the relics of an enormous boar which had long infested the neighbourhood, but was at last slaughtered by the inhabitants.* In the olden time wild-boar hunting was a favourite British sport, and the animal was reckoned among the ordinary English "beasts of venery" down to a comparatively recent period.

Strutt's work on the *Sports and Pastimes of England*, contains an engraving, copied from a manuscript of the ninth century, representing a Saxon chieftain, attended by his huntsmen and a couple of hounds, pursuing the wild swine in a forest; and another picture, showing the mode in which the animal was attacked in the fourteenth century. In the *Book of St Albans*, first printed in 1486 at the abbey of that town, being a series of metrical treatises on hunting, hawking, and angling, written by Dame Juliana Berners, prioress of the nunnery of Sopwell, in the fourteenth century, we are told that the country contains "four manner beastis of venery,"—

"The first of them is the hart, the second is the hare,
The *boar* is one of tho, the wolf, and not one mo."

The borderers of the New Forest, in Hampshire, by paying pawnage, (a trifling acknowledgment at the Steward's Court at Lyndhurst,) enjoy the right of turning their hogs into the forest to feed for six weeks from about the end of September.

"This forest," says Gilpin, "affords excellent feeding for hogs, which are led in autumn into many parts of it, but especially among the oaks and beeches of Boldrewood, to fatten on mast. The first step the swineherd takes, is to select some close sheltered part of the forest, where there is a conveniency of water, and plenty of oak or beech-mast; the former of which he prefers when he can have it in sufficient abundance. He fixes next on some spreading tree, round the bole of which he wattles a slight circular fence of the dimensions he wants, and, covering it roughly with boughs and sods, he fills it plentifully with straw or fern. Having made this preparation, he collects his colony among the farmers, with whom he commonly agrees for a shilling a-head, and will get together perhaps a herd of five or six hundred hogs. Having driven them to their destined habitation, he gives them a plentiful supply of acorns, or beech-mast, which he had already provided, sounding his horn during the repast. He then turns them into

* See *Martine's Reliquiæ Divi Andreæ*, and *Sibbald's History of Fife and Kinross*.

the litter, where, after a long journey and a hearty meal, they sleep deliciously. The next morning he lets them look a little around them, shows them the pool or stream, where they may occasionally drink, leaves them to pick up the offals of the last night's meal, and, as evening draws on, gives them another plentiful repast under the neighbouring trees, which rain acorns upon them for an hour together at the sound of his horn. He then sends them again to sleep. The following day he is perhaps at the pains of procuring them another meal, with music playing as usual. He then leaves them a little more to themselves, having an eye, however, on their evening hours. But, as their bellies are full, they seldom wander far from home, commonly retiring very orderly and early to bed. After this, the swineherd throws the sty open, and leaves them to cater for themselves; and from henceforth has little more trouble with them during the whole time of their migration. Now and then, in calm weather, when mast falls sparingly, he calls them perhaps together by the music of his horn to a gratuitous meal; but in general they need little attention, returning regularly home at night, though they often wander in the day two or three miles from their sty. There are experienced leaders in all herds, which have spent this roving life before, and can instruct their juniors in the method of it. By this management the herds are carried home to their respective owners in such condition, that a little dry meat will soon fatten them. All the swineherds in the forest do not, however, manage their pigs with this exactness. The hog is commonly supposed to be an obstinate, headstrong, unmanageable brute, and may perhaps have a degree of positiveness in his temper; but, if he be properly managed, he is generally docile and orderly. The only difficulty is, to make your meanings, when they are fair and friendly, intelligible to him. Effect this, and you may lead him with a straw. Nor is he without his social feelings when he is at liberty to indulge them. In these forest migrations, it is generally observed, that of whatever number the herd consists, they usually separate, in their daily excursions, into such little knots and societies as have formerly had habits of intimacy together; and in these friendly groups they range the forest, returning home at night in different parties, some earlier and some later, as they have been more or less fortunate in the pursuits of the day. Besides the hogs thus led out in the mast season to fatten, there are others, the property of forest keepers, which spend the whole year in such societies. After the mast season is over, the indigenous forest hog depends chiefly for his livelihood on the roots of fern; and he would find this food very nourishing if he could have it in abundance. But he is obliged to procure it by so laborious an operation, that his meals are rarely accompanied with satiety. He continues, however, by great industry, to obtain a tolerable subsistence through the winter, except in frosty weather, when the ground resists his delving nose; then he must perish if he do not in some degree experience his master's care. As spring advances, fresh grasses and salads of different kinds add a variety to his food; and as summer comes on he finds juicy berries and grateful seeds, on which he lives plentifully till autumn returns, and brings with it the extreme of abundance. In some of the most desolate parts of the forest, there are other hogs which are bred wild, and left to themselves, without any settled habitation. As they cost nothing, either in food or care, their owners are content with the precarious profit of such as they are able to reclaim."

By judicious care and good feeding, pigs can, in a comparatively small space of time, be fattened to an enormous size. Hogs have been made so fat, that their skin was fifteen inches above the bone. In the *Worcester Journal*, May 6, 1841, Mr Walker, of Malvern, is recorded to have killed a Hereford sow, weighing 61 stone 8 lbs., measuring 7 feet 9 inches in length, and 3 feet 3 inches in girth behind the shoulders. She fattened

so rapidly, that she was killed in fourteen weeks from the time that her young ones were taken from her. Dr William Westmacott, in his very entertaining *Scripture Herbal* (1695,) says, "In most countries (as in the woodlands in Worcestershire, and other places) where hogs feed on acorns, the swine's-flesh is rendered hard and sound. One peck of acorns, with a little bran per day, 'tis said, will augment a feeding hog one pound a day in weight for two months together. But 'tis good to macerate the acorns first in water; and if they be powdered or grinded small, they will fat pigeons, turkeys, peacocks, &c. Oak-mast exceeds all other mast of the forest; for the hams from Westphalia and other parts of Germany, are of those swine that feed on acorns; but it is best to give pigs a few peas after them." Pennant says that the great damage done to our fields by the hogs rooting up the ground, is chiefly owing to their searching after the acorns, beech-mast, &c. hoarded up in the earth by the field-mice, in case of a dearth in winter. The plains of Castile grow the finest wheat in the world, and it is given to the pigs, because the grower has no means of conveying it to a market. The Scriptures compare the enemies of our religion to wild-boars destroying the vineyards. Slade, in his *Travels in Turkey*, mentions that the wild-boars come down to the vineyards to eat the grapes. The hog is not only a herbivorous and frugiverous, but, in some degree, a carnivorous animal. "When provoked with hunger," says Barnaby Googe, "the pig will eat not only her own offspring, but young children, which not long since happened in Sussex, to the pitiful discomfort of the parents." Such occurrences have indeed happened often; and old Chaucer notices this propensity, when he speaks of

> "The sow fretting the child right in the cradle,
> The cook scalded for all her long ladle."

A Limerick newspaper some time ago recorded the death of a little child at Golden through injuries received from a pig, which tore its throat, and ate both its arms. On the walls of the church of the Holy Trinity, at Falaise, in Normandy, there was formerly a picture of the punishment of a sow, which in the year 1386 had eaten the face and one arm of a poor labourer's child. The learned judges assembled to inquire into the criminality of the sow, and having found her guilty of *malice prepense*, they condemned her to suffer publicly the penalty of retaliation, as prescribed by law, and then to be hanged by the executioner. The sow's punishment took place in a public square, amidst a great concourse of spectators, the "viscount judge of Falaise" presiding on the solemn occasion on horseback, with a plume of feathers in

his hat; and the father of the child was forced to attend there to witness the spectacle, as a due reward for not taking better care of his offspring. The sow, when brought to execution, had on a mask representing a child's face, and wore a waistcoat, breeches, and gloves.* In Texas, the pigs, relying on the protection afforded by their thick skins, make continual and successful war upon serpents of all kinds. They sally forth to devour the numerous nests of mocassin, king, rattle, and other snakes which infest the fields and woods. Some productions which prove poisonous to man are eaten with impunity by the hog. The author of *Campaigns in Venezuela* mentions that the bitter juice of a species of *Yucca*, which is poisonous to human beings, "is given to hogs in Persia, and is found to fatten them, without doing further injury than causing a slight intoxication, which soon wears off." It is related in *Le Nouveau Cours de Chimie*, that the celebrated Basilius Valentinus, having found that antimony has the property of fattening pigs, tried it on a convent of monks. Unluckily, instead of its increasing the fat of these holy men, it killed them by dozens, whence it obtained from the French the name of *antimoine*.

In Wade's *British History*, it is stated that a gentleman in Norfolk put six pigs, of nearly equal weight, on the same food and litter for seven weeks. Three of the lot were kept as clean as possible with a curry-comb and brush, and were found to consume in seven weeks fewer peas by five bushels than the other three, yet weighed more when killed by two stones and four pounds upon the average,—a strong argument in favour of keeping pigs *personally* clean. From Mr Boswell's experiments on the feeding of swine, published in the *Highland and Agricultural Society's Transactions*, (vol. x.,) we learn, that during an equal space of time, the increase in the live weight of five pigs fed on steam-boiled food was 4 cwt. 2 qrs. 7 lbs., at an expense of L.6 : 19 : 4d., while the increase in the live weight of five pigs on raw food was only 2 cwt. 2 qrs. and 21 lbs., at an expense of L.5 : 8 : 6d.,—a result highly favourable to the practice of feeding swine on steamed food.

"In fattening pigs, I have always found," says Mr J. Steel, "a mixture of barley and peasemeal, moistened with milk in sufficient quantity to make it of a drinkable nature, to be the best; the pigs must be rung to make them lie quiet; the sty should be warm and airy, and the sun not suffered to scorch their backs, as thin-skinned white pigs are blistered by it, which not only renders them of an unsightly appearance, but retards their thriving. They should be protected from exposure to cold winds, cold rains, sleet, and snow—a subject not sufficiently attended to on many farms, where they are allowed to lie in heaps, shivering with

* See *Excursions in Normandy*, and Miss Costello's *Bearn and the Pyrenees*.

the cold, in which case it is utterly impossible that they can thrive. On the other hand, when they are kept constantly in a close pestilential atmosphere, their constitution becomes undermined, they look very delicate and sickly, like consumptive subjects, and never arrive at any size or weight for their age. These extremes must be carefully avoided, and the sty should have an open-barred door, permitting a current of fresh air to incessantly set in and purify the place, conducing to the animals' acquiring a vigorous habit, and a doubly-increased size. Too much cleanliness cannot be observed; for nothing tends more to their well-doing than dry feet, a dry bed, and sweet air. It is true, that in summer they wallow in the mud, to get a coat to shield them from the sun and flies; but this only proves that they require protection from excessive heat and the teasing of flies, and all who wish their pigs to thrive will provide shelter. Pigs intended to fatten should never be allowed to run about, as no food they can get by prowling about will compensate for the loss of flesh sustained by the continual state of motion. In a farm it may be very well to have some running about to pick up dropped offal; but where the pigs are regularly fed with a sufficient supply, it is a thriftless plan to waste by exercise the flesh that by a state of rest would make a good return for the food consumed, and the expense of attendance. The strong food above mentioned is chiefly recommended to fatten hogs to a larger size; but does not exactly suit quarter porkers; it is too heating, and produces pimples which give a diseased appearance; therefore, for quarter pork, use either fine middlings with milk or pure water, or reduce the strength of the barley or peasemeal by adding an equal quantity of pollard; wash or pot liquor is unpalatable to pigs during the process of fattening on meal.

"If, from change of weather or other causes, my pigs get costive and are off their food, I supply them with a little green food, according to the season of the year—as a few cabbage leaves, lettuces, or potato tops, or with potatoes and mangel-wurzel; if, on the other hand, they are purged, I have a sod dug from the roadside and given them; or, which I sometimes think is better, I let them into a yard where there are cinders, mould, brick, and chalk rubbish. I think very little of garden stuff as a means of keeping a pig in a good growing condition; it is no help further than satisfying occasionally the cravings of hunger; sows will do on it, or on grass, if there can be added daily a feed or two from the wash-tub. Sows, during the time of gestation, should have their diet restricted to articles that will not produce obesity; for sows, as well as cows, are apt to be attacked with what is called the milk-fever, and, besides, unwieldy sows have not that command over their movements, that sows with a less proportion of flesh have, and are very likely to crush many of their young ones. For the first fortnight, the sow should be fed in such a manner as to leave off with a good appetite, and no better or more forcing food be given than fine pollard or coarse middlings; but as soon as all fever has disappeared, and the pigs can take the milk as fast as the sow can supply it, the finest middlings or oatmeal, or sometimes boiled rice, when it can be procured at about 8s. or 8s. 6d. a cwt., may be given three times a-day. My little pigs are cut when five or six weeks old; but my sows, if intended for quarter pork, are not spayed, as this operation both throws them back and disfigures them. Many people recommend a spayed sow for the poor, but I always recommend a barrow pig, as growing to a larger size than the spayed sow pig, and its being far superior meat to an old spayed sow. In choosing a pig, look out for one with a wide open chest, well filled up from the ears to the tail, small-toed, and with meat in the fore-arm down to the knee, and in the ham down to the hock; a fine and short tail, with a small spread of hairs at the end. Let the breed be more inclined to make flesh than fat, and fine in the grain; and the preference should be given to a breed famed for broad backs and small entrails—for large bellied pigs do not pull down the scale." *

The newspapers, in December 1841, recorded that a sow, belonging to Mr Godfrey Weston of Wymondham, Norfolk, had 33

* For further information on fattening swine, see the *Journal of Agriculture* for September 1839.

pigs in one litter. She had littered twice previously, and had 22 pigs in one litter. The *Carnarvon Herald*, December 4, 1841, mentioned, that a sow, belonging to the Reverend W. Wyatt of Dyserth, had produced, in three successive litters, 57 pigs.

Although the fourteenth chapter of *Deuteronomy* prohibits the eating of pig-meat, and it is refused by all strict Jews and Mahometans, it is universally eaten by Christians. It is wholesome and nourishing food. A rasher of fat bacon at breakfast is recommended by medical men to assist the weak stomachs of bilious persons.

The dung of swine is a cooling rich manure for dry sandy ground; but from their eating numerous weeds, which pass too soon through their intestines to allow of their seeds being destroyed, this manure is not so fit for arable lands, but is very good for the roots of fruit-trees. Five years ago the Duke of Portland commenced strengthening and promoting the growth of trees in his grounds about Welbeck, by putting pigs in the plantations, and confining them within a certain space till they had rooted up the ground at the foot of the trees, and of course manured the soil. They were then removed to the other parts of the plantation, and confined in the same way, and were fed meanwhile upon potatoes, large quantities of which were bought for that purpose. Mr J. Hawkins tells us that a method has lately been adopted in some parts of the United States of procuring oil and spermaceti from pigs. The pigs are driven into the woods to feed, and, after some months, they are brought back and fattened with Indian corn. They are then killed and boiled altogether, to extract all their lard, which is then converted into *stearine* and *elain*. The oil thus procured is of a remarkably fine quality, and well adapted for lubricating machinery.

*The Chemical Nature of Grass and Hay as Food for Cattle.**—By Robert D. Thomson, M.D., Lecturer on Practical Chemistry in the University of Glasgow.—Grass, as may be readily imagined, varies very considerably in its composition, according to its age, and also, as may be expected, according to its species. The experiments undertaken during the present investigation have sufficiently demonstrated the first of these positions. But the second is still open for inquiry, since chemists who have previously analysed grass and hay have omitted to particularise the botanical names of the plants which they have examined. The grass used in the present experiments consisted almost entirely of rye-grass, (*Lolium perenne;*) and the hay employed was also similarly constituted. The amount of solid matter in this grass [illegible] from 1[illegible] to upwards of 30 per cent, according to the [illegible] growth. The grass made

* [illegible]nment Report just published.

use of in the first experiment contained from 18 to 25 per cent; and in our calculations the latter number has been adopted. When grass first springs above the surface of the earth, the principal constituent of its early blades is water, the amount of solid matter being comparatively trifling; as it rises higher into day, the deposition of a more indurated form of carbon gradually becomes more considerable; the sugar and soluble matter, at first increasing, then gradually diminishing, to give way to the deposition of woody substance. The following table affords a view of the composition of rye-grass before and after ripening:—

	June 18.	June 23.	July 13.
Water,	76.19	81.23	69.00
Solid matter,	23.81	18.77	31.00

These are important practical facts for the agriculturist; for if, as we have endeavoured to show, the sugar is an important element of the food of animals, then it should be an object with the farmer to cut grass for the purpose of hay-making, at that period when the larger amount of matter soluble in water is contained in it. This is assuredly at an earlier period of its growth than when it has shot into seed; for it is then that woody matter predominates—a substance totally insoluble in water, and therefore less calculated to serve as food to animals than substances capable af assuming a soluble condition. This is the first point for consideration in the production of hay, since it ought to be the object of the farmer to preserve the hay for winter use in the condition most resembling the grass in its highest state of perfection. The second desideratum in hay-making is to dry the grass, under such circumstances as to retain the soluble portions in perfect integrity. To ascertain whether hay, by the processes and exposure which it undergoes, loses any of its soluble constituents, the following experiments were made:—

1. 3000 grains of rye-grass in seed, on the 13th July, gave up to hot water a thick syrupy fluid, which, when dried till it ceased to lose weight at 212 deg., weighed 217.94 grains—equivalent to 7.26 per cent.

2. 2500 grains of rye-grass digested in cold water, yielded 53.23 grains of extract—equal to 2.12 per cent. This rye-grass contained 31 per cent of solid matter, and 69 per cent of water.

3. New hay made from rye-grass, and containing 20 per cent of water, for the sake of comparison was also subjected to similar trials.

1. 1369 grains gave to hot water 220.77 grains of extract=16.12 per cent.
   1000 do. do. 159.34 do. do. =15.93 do.
   1000 do. do. 140. do. do. =14. do.

2. 2000 grains of new hay in seed, digested in cold water, yielded 101.3 grains of extract, equal to 5.06 per cent of soluble matter.

From these numbers, we learn that 100 parts of hay are equivalent to $387\frac{1}{2}$ of grass. This amount of grass should contain, of soluble matter in hot water, 28.13 parts; and in cold water 8.21 parts. But the equivalent quantity of hay, or 100 parts, only contains 16 instead of 28 parts soluble in hot water, and 5.06

instead of 8¼ parts soluble in cold water. A very large proportion of the soluble matter of the grass has obviously disappeared in the conversion of the grass into hay. The result of the haymaking in this particular instance has therefore been to approximate the soft, juicy, and tender grass to woody matter, by washing out or decomposing its sugar and other soluble constituents. These facts enable us to explain the reason why cattle consume a larger amount of hay than is equivalent to the relative quantity of grass. Thus an animal which can subsist upon 100 lbs. of grass, should be able to retain the same condition by the use of 25 lbs. of hay, if the latter suffered no deterioration in drying. The present series of experiments, however, show that a cow, thriving on 100 to 120 lbs. of grass, required 30 lbs. of hay, and 9 lbs. of barley or malt—affording thus collateral evidence of the view which we have taken of the imperfection of the process of hay-making at present in use in this country.

The great cause of the deterioration of hay, is the water which may be present, either from the incomplete removal of the natural amount of water in the grass by drying, or by the absorption of this fluid from the atmosphere. Water, when existing in hay from either of these sources, will induce fermentation—a process by which one of the most important constituents of the grass—viz., sugar—will be destroyed. The action necessary for decomposing the sugar is induced by the presence of the albuminous matter of the grass; the elements of the sugar are made to react on each other in the moist state in which they exist in consequence of the presence of the water and oil, and are converted into alcohol and carbonic acid according to the following formula:—

	C.	H.	O.
1 atom sugar, ...	12	12	12
2 atoms alcohol, ...	8	12	4
4 atoms carbonic acid, ...	4	0	8

That alcohol is produced in a heated hay-stack in many cases, may be detected by the similarity of the odour disengaged to that perceptible in a brewery. We use this comparison, because it has been more than once suggested to us by agriculturists. The quantity of water or volatile matter capable of being removed from hay at the temperature of boiling water, varies considerably. The amount of variation during the present experiment was from 20 to 14 per cent. If the lower per centage could be attained at once by simple drying in the sun, the process of hay-making would probably admit of little improvement; but the best new-made hay that we have examined, contained more than this amount of water, the numbers obtained verging towards 20 per cent. When it contains as much as this, it is very liable to ferment,

especially if it should happen to be moistened by any accidental approach of water. The only method which we have found to succeed in preserving grass perfectly entire, is by drying it by means of artificial heat. Rye-grass contains at the earlier period of its growth as much as 81 per cent of water; the whole of which may be removed by subjecting the grass to a temperature considerably under that of boiling water; but even with a heat of 120 deg., the greater portion of the water is removed, and the grass still retains its green colour—a character which appears to add greatly to the relish with which cattle consume this kind of provender. When this *dried grass*, as it may be truly termed by way of distinction from hay, is examined, it will be found to consist of a series of tubes, which, if placed in water, will be filled with the fluid, and assume in some measure the aspect of its original condition. In this form, cattle will eat it with relish, and prefer it to hay, which, in comparison, is blanched, dry, and sapless.

The advantages attained by this method of making hay, or rather of preserving grass in a dry state, are sufficiently obvious. By this means all the constituents of the grass are retained in a state of integrity. The sugar, by the absence of water, is protected from undergoing decomposition; the colouring matter of the grass is comparatively little affected while the soluble salts are not exposed to the risk of being washed out by the rains, as in the common process of hay-making. The amount of soluble matter capable of being taken up by cold water is, according to the preceding trials, as much as 5 per cent, or a third of the whole soluble matter in hay. We may, therefore, form some notion of the injury liable to be produced by every shower of rain which drenches the fields during hay harvest. It is not only, however, the loss which it sustains in regard to the sugar and soluble salts that renders hay so much less acceptable than grass to the appetite of cattle. The bleaching which it undergoes in the sun deprives it of the only peculiarity which distinguishes the one form of fodder from the other. Grass, deprived of its green colouring matter, presents exactly the appearance of straw, so that hay ought to be termed grass straw. It is obvious from the experiments detailed, that the operation of hay-making, as conducted in this country, has a tendency to remove a great proportion of the wax in the grass. Thus it was found that rye-grass contained 2·01 per cent of wax. Now, as 387½ parts of rye-grass are equivalent to 100 parts of hay; and as 387½ parts of grass contain 7·78 parts of wax, it is obvious that 100 parts of hay should contain the same amount of wax; but by experiment it was found that 200 grains of hay contained 4 grains of wax, which is equivalent to 2 per cent, almost exactly the amount contained in

grass. Hence it appears that no less than 5·78 grains of wax have disappeared during the hay-making process. The whitening process which the grass undergoes in drying, renders it apparent that the green colouring matter has undergone change, but that it should have been actually removed to such an extent, or, at least, have become insoluble in ether, is a result which could scarcely have been anticipated without actual experiment. Some improvement in the preparation of hay is imperatively demanded in such localities as are affected with a more than usual fall of rain. The following table of the fall of rain will point out where such precautions are more particularly required:—

	Inches.		Inches.
Glasgow, -	21·3	Lancaster,	39·7
London .	24·0	Strathaven,	45·8
Edinburgh,	24·5	Paisley,	47·1, at the Reservoir.
Berwickshire,	32·5, Abbey St Bathans	Greenock,	61·8, 800 feet above the town.
Manchester,	36·1		

Frequently the quantity of rain which falls in May and June, the hay-making season, is greater than in April and July. In those localities where the fall of rain is so considerable, the preparation of good sound hay by the usual process will be almost impracticable; and in such places too frequently, hay in a state of decomposition is given to animals at the risk of their being seriously injured; since all food, whose particles are in a state of fermentation or putrefaction, which are analogous actions, must have a tendency to produce similar decompositions in the fluids of the animal system.

In the neighbourhood of manufacturing towns there could be no difficulty in preparing abundance of hay by the process now recommended. The waste heat of the chimneys might be sent through apartments or sheds of almost temporary construction, guided by a proper draught, so as to carry off the vapour as soon as it is volatilized, and the same arrangements might with economy be adopted in conjunction with brick and tile works. Hay-making would thus commence at a much earlier period of the season. The grass would be cut, carted to the drying-room, and in the course of a few hours be ready for stacking. When hay prepared in this manner is to be given to cattle or horses, it may be steeped in a tank for twenty-four hours, or any adequate period, before being placed in the racks and boxes, and the steep-water, which will contain sugar and soluble salts, should be given them to drink. By this system of preserving grass we should be continuing to our cattle in winter our summer food, which all admit to be superior to every other substitute; and while the animals them-

selves would be benefited, much uneasiness and trouble in winter would be saved to the farmer.

In a moist climate, especially like that exhibited in Scotland during the last year, it appears highly desirable that farmers should possess on their premises a drying-room, where hay, potatoes, and even corn might be dried. Had such a convenience been attached to many of our farmers' offices last season, much corn might have been saved, even by drying one or two cart-loads daily. This desideratum might be affected by running a flue through the barn level with the floor—its upper surface being covered with iron-plate or tiles. By means of a small quantity of fuel, a barn full of corn in sheaves, properly disposed, might be dried in a few hours.

The constituents of the rye grass washed out by rain, would be principally the sugar and soluble salts. The nature of the inorganic salts, both of the stem of the grass when dried as hay, and of the seeds, is as represented in the following tables.

100 parts of the stem and seeds were composed as follows:—

	Stem.	Stem.	Seed.
Water,	15.50	19.30	11.376
Organic Matter,	79.52	75.72	82.548
Ash, . .	4.98	4.98	6.076

Table of Saline Matter in Stem and Seeds of Lolium Perenne.

	Stem.	Seed.
Silica, .	64.57	42.28
Phosphoric Acid,	12.51	18.89
Sulphuric Acid,	.	3.12
Chlorine, .	.	trace
Carbonic Acid,	.	8.61
Magnesia,	4.01	5.31
Lime, . .	6.50	18.55
Peroxide of Iron,	0.36	2.10
Potash, .	8.03	4.80
Soda, .	2.17	1.38 *

A comparison of the two columns of this table adds another argument to that already brought forward against the practice of allowing rye-grass to come to seed before cutting it for hay; since the seed tends to remove a much larger proportion of phosphoric acid from the soil than the stem—the quantity of this acid found in the seed exceeding that in the stem by one-third. A similar observation, with greater force, applies to the lime, as the amount of this earth is two-thirds greater in the seed than in the

* In these analyses I was assisted by my pupil Mr M'Latchie.

stem. The quantity of alkalies is twice as great in the stem as in the seed, while the total ash of the seed is a sixth part inferior in amount to that of the stem.

On the Cultivation of the Filbert Nut. By Mr MAIN.—The filbert is a universal favourite, especially with those who retain the power of mastication. They are always a welcome dish in the dessert, and preferred by many to much more luscious fruit. Every owner of a garden chooses to have a few nut-trees; but it is in but few places where the management of the trees are well understood. In the county of Kent, there are extensive and profitable orchards of filbert-trees; and there the farm-labourers are adepts at the proper method of rearing and pruning the trees. The filbert is only an improved hazel—the latter being the wild original, or crab; while the former is an accidental variety, and, as such, cannot be certainly propagated by sowing the nuts—that is, the seeds; for not one in ten of the plants raised from seeds would prove filberts, but common hazel-nuts only. In order to have the true variety, the young trees should be raised from layers, and these, after being rowed out in nursery order for two or three years, in which time they are trained to one upright shoot of not less than three feet high, all suckers and branchers on the lower part of the stem being constantly removed. The trees, after being planted in their final stations, are headed down to about eighteen inches from the ground. This height will admit of a clear stem of twelve inches below, and which part must be at first, and ever afterwards, left free from shoots. This removal of shoots and suckers will cause the buds at top to shoot with greater vigour. If eight strong shoots be produced in the first summer, they must be carefully preserved, as that number is required to form the head; but if less than this number come forth, then two or three of the strongest must be shortened back to half their length at the next pruning, in order to obtain the requisite number.

A sufficient number of branches being obtained, if not in the [illegible]st, certainly after the second pruning, they are to be carefully preserved, and trained outwards and upwards—at first nearly horizontal, but curving gradually upwards to the point. The [illegible]est mode [illegible]ng this is by using a hoop of the proper size placed with[illegible] [illegible]oots, and to which the latter are tied at equal [illegible] [illegible]ances, in divergent order. Such a lateral [illegible] [illegible] be much assisted by a careful pruner [illegible] outside bud, which, when prolonged first [illegible] [illegible]turally turns upwards into the due position, to form [illegible] branches. The branches are allowed to rise to [illegible] higher and the middle of the

tree, or rather bush, is always kept free from shoots, so that a well-trained head resembles a large bowl.

The subsequent management of the trees, both while gaining the desired form, and after having gained it, consists in preserving all the short spurs which are produced on the branches, and cutting away or shortening the lateral shoots, which every year rise from the same. The treatment of these laterals is of great importance; if they exceed the length of six inches, they may be cut back to a few buds; but if less, they should be preserved, as the points are generally fruitful. The grand object of the pruner is to have the branches thickly furnished with fruitful spurs, and which are only reduced in length, when, after a few years' growth, they become too distant from the branch, when they are cut back to a healthy spur behind. If any part of the branch becomes accidentally naked, a strong shoot from the bottom may be led up, and managed so as to fill up the vacancy.

When filbert-trees are thus managed, and have arrived at their full volume in width and height, they may be kept in the same state for many years by the knife only, and with the requisite skill in using it.

There are but few situations in this country where filberts would be considered as an object by the agriculturist; but, as already observed, they are desirable in every well-fenced garden, in which a row of half a dozen or a dozen trees might be judiciously introduced. Naturally the *Corylus avellana*, or filbert, ranks not as a tree, but as a shrub, because it is what is called a *stoling* plant—that is, it increases itself by numerous suckers from the roots, and, instead of one principal stem, or central axis, is divided into many, the younger constantly robbing the older branches of their fertility and vigour. Depriving them therefore of the suckers, induces a stronger expansion of the fructiferous organization. This, indeed, is a rule which obtains amongst all plants which propagate themselves by both seeds and suckers, or by seeds and tubers—by checking the increase or completion of the one, increases and amplifies the other; hence the propriety of preventing all growth of suckers from the roots of filbert trees.

The Kentish cultivators, who are neither botanists nor vegetable physiologists, are nevertheless well aware of the functions of the male catkins of the nut-tree, rejoicing to see them plentiful, and carefully preserving them. From the greater or lesser numbers of the catkins, they usually predict what share of crop will follow.

It is remarkable, too, in respect to this genus of plants, that if there be an accidental scarcity of catkins upon the cultivated

plants, that a branch having an abundance of catkins cut from the wild hazel, and suspended over the branches of the filbert-trees early in spring, the little pink female flowers of the latter will, in all probability, be fecundated by the strange pollen, and so rendered fertile. This has been tried and proved repeatedly.

I remember, when a boy, that there were some very large filbert-trees growing in the old kitchen garden belonging to Pinkie House, and then let to a market gardener. But these trees were seldom fruitful; their culture not being well understood at that period. A few of the branches were allowed to run away in a lofty rambling manner; and choked at bottom by a multiplicity of suckers, which completely exhausted the prolific powers of the trees.

Filberts intended for long keeping should remain on the tree until thoroughly ripe, which is easily known by their rich brown colour. They should be laid on a dry airy floor for a few days, and afterwards stored in jars of dry sand, where they will keep sound for a great length of time.

There are five varieties of the filbert, namely, the red, so called from the kernel and autumn foliage being of a reddish colour; the white, which is more common, and a good bearer; the frizzled, so called from having small indented leaves round the nut; the large cob, or Barcelona nut; and the Cosford, which is only an unusually large hazel-nut.. The first and second are the most valued sorts. *Extracts chiefly from the "Fruit Cultivator," edited by J. M.*

Plan for reducing the price of Guano twenty-five per cent.—Guano is now so well known as an excellent promoter of green crops, that its use may be said to be firmly established in the husbandry of this country. Its supply, as is well known, is now confined to one quarter of the globe, where its price has always been very high, in consequence of a tax which is levied on its export. It therefore becomes [illegible] [illegible]eration for the farmer to devise any mean[illegible] [illegible] high price of this useful [illegible]

A [illegible] and it is this:—[illegible] every [illegible] Britain [illegible] land subscribe a small su[illegible] [illegible]gregate may be [illegible], which, he con[illegible] in the price of [illegible], be employed in [illegible] other a shipmaster, [illegible] the coast or on the

islands which contain guano of the best description, and to calculate the quantity which might be obtained for any future number of years. Let the remainder of the money be employed in the purchase of ships to bring home the guano in an unadulterated state. The interest of the farmer and of the shipper being, in these circumstances, one and the same, none but the best guano would, of course, be sent home; and, on its arrival in this country, the agriculturists could use means to prevent its adulteration before it reached their hands. A second-hand ship, to hold 700 or 800 tons, may perhaps be purchased for £2000 or £3000, and every ship being constantly employed in the trade, their number need not be greater than would just be sufficient to bring home the requisite quantity every year. A local board of farmers could be formed in any part of the country to superintend the transmission of the article from the principal sea-ports. Guano being now so important an article of trade, it would be worthy the attention of our Government to negotiate with that of Peru on the expediency of lowering or abolishing the export duty. Were such a plan adopted, our correspondent is of the opinion that none but genuine guano would ever be imported, and that at a cost at least twenty-five per cent below the present prices.

AGRICULTURAL REPORT.

June 1846.

After an unusually mild winter, the spring was expected with much anxiety, from the natural apprehension that a long track of good weather would be followed by one of an opposite character; and the anticipation was realised, as the winter was dry as well as mild, and the spring was both wet and cold. The wet weather continued until the spring corn was all sown, and consequently its seed-bed was not prepared in so dry and mellow a state as could have been desired.

The leaves of the autumn sown wheat were generally observed to have assumed a brown colour, indicating weakness in its vegetation, occasioned no doubt by an excess of moisture in the ground, as the wettest lands bore the brownest coloured wheat. Indeed, so late as the beginning of May much of the flat lands of the midland counties of England were quite inundated. This season, therefore, is one among the many which strongly indicates the necessity of draining land which rests on any sort of retentive subsoil. This untoward state of the soil prevented the proper cleaning in time of the potato and turnip land.

Towards the latter end, however, of the turnip season, the weather became both dry and warm, and the heat of the air, and the splendour of the sky, have increased ever since in a steady ratio. The temperature has ranged during the day in the shade from 70° to 76°, and as late as six in the evening it has stood at 108° in the sun. Occasionally the air feels very sultry, during which, distant rolls of thunder are heard, accompanied with slight showers. The heat at present reminds us of 1826, but with this very important distinction in favour of 1846, that the ground being thoroughly saturated with rain before the apearance of the heat, it is in a better state to support a rapid and luxuriant vegetation.

The young red clover plant was observed to be strong and healthy all winter,

but now that the hay crop has approached maturity, the clover proves deficient. Its destruction had perhaps been effected by the three successive days and nights of hard frost in February, or more probably by the combined wetness and cold of April; and yet clover, where it is sown alone, is a heavy crop in many parts of England, especially on the chalky soils. The pastures are abundant, because they were not touched at all by stock until late in the season—the immediate effect of which is to increase the extent of the hay crop—in consequence of the abundance of turnips to support the stock for a much longer period than usual. This is the only season in which we ever witnessed the slicing down of turnips for manure in want of stock to consume them. The mild winter put the ewes on hill and dale in fresh condition, so as they have been enabled to nurture their lambs to maturity.

Much interest is naturally excited regarding the future fate of the potato crop. It is perhaps yet too early to pronounce a decided opinion of what the crop will be in autumn; but in every instance which has fallen under our own observation, the plant has come up regularly and strong. The potato set, it should be observed, was placed in the ground when the latter was in a favourably moist state; and this circumstance, we apprehend, goes far in all seasons to prevent the occurrence of the ordinary dry rot; for, as to the disease of last year, we have no expectation of meeting with it, until such a season as the last again occurs. In partial corroboration of this expectation, we may state the results of an experiment, in so far as it has as yet proceeded, of purposely planting in a garden, in November last, diseased and sound sets in alternate rows, and the plants from both sets have come up and are growing equally strong and healthy. No doubt many such experiments are being tried in gardens; but has any one thought of trying a similar one in the field, and on a large scale?

Butcher-meat still fetches high prices, notwithstanding the number of foreign cattle presented in our markets. The cause may be found in the increased demand for butcher-meat by the numerous bands of well-paid labourers employed on the railways; and the high price may be expected to continue as long as the formation of railways are sanctioned by Parliament. It is true the price of fat cattle has declined of late, owing to the heat causing meat soon to corrupt; but such a cause is of a temporary character.

FOREIGN MARKETS, per Imperial Quarter, free on board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1846.							
Feb.	Danzig.	53/ to 60/	20/ to 26/	15/ to 18/	26/ to 29/	38/ to 40/	33/ to 39/
March.	......	52/ . 57/	22/ . 28/	16/ . 19/	28/ . 31/	36/ . 38/	32/ . 37/
April.	......	50/ . 55/	21/ . 26/	17/ . 20/	29/ . 32/6	32/ . 37/	30/ . 36/
May.	......	48/ . 52/	20/ . 24/	16/ . 18/	32/ . 36/	30/ . 34/	29/ . 35/6
Feb.	Hamburg.	48/ . 57/	18/ . 21/6	14/6 . 18/6	28/ . 32/6	32/ . 36/6	32/ . 35/6
March.	......	45/ . 54/	20/ . 23/6	15/ . 19/6	29/ . 33/	30/ . 36/	30/ . 34/
April.	......	42/ . 50/	22/ . 25/6	16/6 . 22/	30/ . 32/6	31/ . 35/	30/6 . 33/6
May.	......	42/ . 48/3	20/ . 24/3	17/ . 21/3	28/ . 31/6	30/ . 34/	32/6 . 39/
Feb.	Bremen.	46/ . 55/	21/ . 27/6	15/ . 18/6	26/ . 29/6	36/ . 40/	33/ . 40/
March.	......	42/6 . 53/	22/6 . 28/	17/ . 22/	28/ . 30/	35/ . 38/	32/ . 38/
April.	......	40/6 . 50/	23/ . 29/	18/ . 24/	29/ . 32/	34/ . 36/6	30/ . 36/
May.	......	41/ . 49/6	21/6 . 28/	16/ . 23/	30/ . 34/	32/ . 35/	29/ . 34/6
Feb.	Konigsberg	46/ . 52/	23/ . 28/	15/ . 21/6	30/ . 33/	32/ . 38/	32/ . 36/
March.	......	42/ . 50/	22/6 . 26/	15/6 . 21/	29/6 . 32/	30/ . 34/	30/ . 34/
April.	......	40/ . 48/9	22/ . 27/6	16/ . 20/	28/ . 31/6	26/ . 28/	29/ . 32/
May.	......	44/ . 53/	21/ . 26/	15/ . 20/	28/ . 30/	28/ . 32/	30/ . 34/

[illegible] 7/ to 7/6 per Quarter to [illegible]

TABLE OF PRICES, &c.

he Average Prices of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets :—

LONDON.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1846.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 7.	58 2	32 8	24 2	37 8	39 0	37 4
14.	60 4	31 5	23 9	37 10	39 2	35 6
21.	59 6	30 0	23 3	37 11	38 1	34 11
28.	59 2	29 9	22 3	37 0	39 0	33 5
Mar. 7.	61 2	28 10	22 9	36 7	38 3	35 4
14.	58 10	30 5	23 2	37 4	38 1	34 9
21.	59 6	30 5	22 11	36 0	35 0	34 10
28.	58 3	31 5	23 8	35 2	35 1	34 0
Apr. 4.	60 2	32 5	23 6	35 5	39 6	33 10
11.	60 1	31 7	23 11	34 5	36 0	34 2
18.	61 10	30 10	23 4	36 2	36 11	33 3
25.	58 2	31 10	24 6	34 4	35 3	34 1
May 2.	59 11	30 9	24 7	34 0	35 10	33 9
9.	62 2	29 10	24 9	33 8	38 0	34 2
16.	62 0	29 8	24 8	33 3	38 3	34 11
23.	59 0	30 5	24 0	34 5	37 6	34 6
30.	54 6	28 0	24 2	32 4	34 11	35 1

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1846.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 4.	52 2	30 0	22 8	40 0	39 6
11.	51 10	30 6	26 3	39 8	39 2
18.	51 1	31 8	27 2	41 0	42 0
25.	52 0	30 2	29 7	40 0	39 8
Mar. 4.	51 1	32 0	30 5	39 0	39 4
11.	55 6	32 6	32 5	40 0	41 2
18.	59 0	33 10	32 4	38 10	39 2
25.	57 10	33 4	31 8	42 0	44 0
Apr. 1.	56 7	33 8	31 7	41 0	42 0
8.	57 5	33 5	32 9	42 0	42 0
15.	57 0	33 0	33 6	39 6	39 0
22.	55 3	33 5	31 4	39 6	40 1
29.	55 9	33 1	30 10	40 6	42 0
May 6.	56 7	32 8	31 3	41 0	42 0
13.	53 4	32 5	31 4	42 0	42 0
20.	53 6	32 8	30 9	41 0	41 8
27.	54 2	31 6	31 3	41 6	42 0

LIVERPOOL.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1846.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 7.	52 11	29 1	24 10	37 4	41 6	43 0
14.	52 4	31 11	24 4	37 8	41 0	38 10
21.	50 6	30 10	24 6	38 0	40 1	39 8
28.	50 1	32 2	25 1	37 6	35 2	38 5
Mar. 7.	49 10	31 2	24 2	36 4	36 5	40 10
14.	51 1	32 10	25 3	34 2	39 3	40 8
21.	53 9	31 10	24 11	34 0	40 4	40 0
28.	51 0	30 7	24 7	33 4	39 4	39 9
Apr. 4.	53 3	32 0	20 2	32 8	37 9	38 1
11.	52 10	30 6	23 0	31 2	37 0	38 2
18.	53 5	28 6	26 2	31 6	39 2	39 7
25.	54 10	30 7	25 10	31 10	40 2	38 0
May 2.	56 0	30 6	26 2	32 6	38 4	39 2
9.	54 4	30 7	26 5	32 9	39 2	40 7
16.	53 7	29 6	25 8	33 2	40 2	41 4
23.	52 1	28 5	26 8	33 8	38 10	39 6
30.	51 1	33 1	25 11	34 1	42 7	39 11

DUBLIN.

Date.	Wheat, p. barl. 20 st.	Barley, p. barl. 16 st.	Bear, p. barl. 17 st.	Oats, p. barl. 14 st.	Flour, p. barl. 9 st.
1846.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb. 3.	28 4	14 0	11 9	12 10	15 9
10.	27 5	14 3	11 6	12 10	14 10
17.	28 4	16 3	12 4	13 5	14 11
24.	28 7	14 6	12 8	12 7	15 4
Mar. 3.	29 2	14 2	12 9	13 0	16 0
10.	29 5	14 8	13 0	13 9	15 3
17.	29 3	14 7	13 2	13 6	17 0
24.	29 8	15 2	13 6	14 0	16 3
31.	29 7	15 6	13 4	14 6	17 2
Apr. 7.	30 1	15 9	13 0	14 0	16 5
14.	30 6	16 0	13 2	14 6	16 8
21.	31 0	16 5	13 10	16 0	17 0
28.	33 0	16 11	14 2	16 4	17 9
May 5.	33 6	16 9	14 4	16 0	17 9
12.	32 5	15 10	14 0	15 4	17 10
19.	30 3	15 6	14 5	15 0	17 9
26.	30 4	15 1	13 8	14 9	17 6

TABLE showing the Weekly Average Price of GRAIN, made up in terms of 7th and 8th Geo. IV., c. 58, and 5th Vict., c. 14, and the Aggregate Averages which regulate the Duties payable on FOREIGN CORN: the Duties payable thereon, from February to June 1846.

Date.	Wheat. Weekly Average.	Wheat. Aggreg. Average.	Wheat. Duty.	Barley. Weekly Average.	Barley. Aggreg. Average.	Barley. Duty.	Oats. Weekly Average.	Oats. Aggreg. Average.	Oats. Duty.	Rye. Weekly Average.	Rye. Aggreg. Average.	Rye. Duty.	Pease. Weekly Average.	Pease. Aggreg. Average.	Pease. Duty.	Beans. Weekly Average.	Beans. Aggreg. Average.	Beans. Duty.
1846.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Feb 7.	54 3	55 4	17 0	30 10	31 7	7 0	21 7	21 11	6 0	34 2	34 4	8 6	35 6	37 6	5 6	35 9	36 5	6 6
14.	54 9	55 3	17 0	30 6	31 4	7 0	21 9	21 10	6 0	32 7	34 2	8 6	35 7	36 11	6 6	34 9	35 11	7 6
21.	55 0	55 1	17 0	29 11	31 0	7 0	21 6	21 9	6 0	32 10	34 0	8 6	34 3	36 2	6 6	34 8	35 7	7 6
28.	54 6	54 9	18 0	29 7	30 8	8 0	21 4	21 8	6 0	33 4	33 9	9 6	35 2	35 6	7 6	34 2	35 2	7 6
Mar. 7.	54 10	54 8	18 0	29 3	30 3	8 0	21 10	21 8	6 0	33 6	33 1	9 6	33 8	35 0	7 6	34 11	35 0	7 6
14.	54 3	54 7	18 0	29 4	29 11	9 0	21 9	21 8	6 0	34 2	33 5	9 6	34 9	34 10	8 6	35 2	34 11	8 6
21.	55 1	54 9	18 0	29 10	29 9	9 0	22 0	21 0	6 0	33 10	33 4	9 6	33 4	34 5	8 6	34 4	34 8	8 6
28.	55 5	54 10	18 0	30 2	29 8	9 0	22 1	21 9	6 0	34 0	33 7	9 6	33 3	34 1	8 6	35 0	34 9	8 6
Apr. 4.	55 9	54 11	18 0	30 7	29 10	9 0	22 6	21 11	6 0	33 7	33 9	9 6	34 3	34 0	8 6	34 10	34 9	8 6
11.	56 0	55 3	17 0	30 9	30 0	8 0	22 9	22 2	6 0	33 4	33 9	9 6	33 8	33 9	9 6	35 1	34 11	8 6
18.	55 10	55 5	17 0	30 5	30 2	8 0	22 9	22 4	6 0	35 5	34 1	9 6	34 5	33 11	9 6	34 9	34 10	8 6
25.	55 6	55 7	17 0	30 1	30 4	8 0	23 4	22 7	6 0	33 7	33 11	9 6	33 10	33 9	9 6	34 10	34 10	8 6
May, 2.	56 5	55 11	17 0	29 8	30 3	8 0	23 7	22 10	6 0	32 5	33 9	9 6	33 10	33 10	9 6	34 11	34 11	8 6
9.	56 8	56 0	16 0	29 7	30 2	8 0	23 9	23 1	5 0	33 5	33 7	9 6	34 7	34 1	8 6	35 8	35 0	7 6
16.	57 0	56 2	16 0	29 4	29 11	9 0	24 1	23 4	5 0	33 5	33 7	9 6	34 11	34 3	8 6	35 11	35 2	7 6
23.	55 5	56 2	16 0	28 10	29 8	9 0	23 8	23 6	5 0	34 6	33 9	9 6	34 6	34 4	8 6	36 0	35 4	7 6
30.	53 4	55 9	17 0	28 4	29 4	9 0	23 9	23 8	5 0	32 4	33 3	9 6	34 2	34 3	8 6	35 10	35 6	7 6

7th MONTHLY RETURNS, published in terms of 9th Geo. IV. c. 60, shewing the Qua[ntities of] Corn, Grain, Meal, and Flour imported into the United Kingdom in each Month; the Q[uantities] upon which duties have been paid for home-consumption, during the same Month; and th[e Quan]tities remaining in Warehouse at the close thereof, from 5th February to 5th May 1846.

Month ending	IMPORTED. From Foreign Countries.	IMPORTED. From British Possessions.	IMPORTED. Totals.	CHARGED WITH DUTY. From Foreign Countries.	CHARGED WITH DUTY. From British Possessions.	CHARGED WITH DUTY. Totals.	REMAINING IN WAREH[OUSE]. From Foreign Countries.	REMAINING IN WAREH[OUSE]. From British Possessions.	T[otals].
Feb. 5 1846	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qrs. Bu.	Qr
Wheat....	160,690 4	4,370 3	165,060 7	3,032 6	2,918 4	5,951 2	1,055,651 3	6,129 4	1,0[illegible]
Barley....	25 831 6	44 2	25,876 0	3,134 4	44 2	3,178 6	74,467 5	... ...	7
Oats.......	35,024 2	908 3	35,932 5	4,952 2	908 3	5,860 5	82,619 6	... ...	8
Rye........	39 2	... ...	39 2	... ...	... ...	... ...	163 2	... ...	
Pease	13,337 7	2,133 4	15,471 3	15,920 3	474 2	16,394 5	2,290 4	1,885 7	
Beans.....	24,180 1	... ...	24,180 1	20,486 5	... ...	20,486 5	4,757 6	... ...	
Totals,	200,103 6	7,456 4	207 860 2	47,526 4	4,345 3	51,871 7	1,219,950 2	8,015 3	1,22
Mar. 5 1846.									
Wheat....	89,379 4	36 4	89.416 0	1,241 6	571 4	1,813 2	1,133,356 4	5,594 4	1,13
Barley....	6,830 3	10 6	6,841 1	39 3	10 6	50 1	82,919 2	... ...	8
Oats.......	15,724 2	25 2	15,749 4	121 7	25 2	147 1	96,983 5	... ...	9
Rye........	... ...	... ...	... ...	... ...	... ...	... ...	163 2	... ...	
Pease	4,397 6	72 6	4,470 4	80 6	72 6	153 4	6,641 7	1,885 7	
Beans.....	9,340 1	... ...	9,340 1	580 2	... ...	580 2	13,413 2	... ...	1
Totals,	125,672 0	145 2	125,817 2	2,064 0	680 2	2,744 2	1,333,477 6	7,480 3	1,34
Apr. 5 1846.									
Wheat....	116,281 5	619 4	116,901 1	881 6	3,341 5	4,223 3	1,224.502 7	2,872 0	1,22
Barley....	6,207 6	... ...	6.207 6	34 3	... ...	34 3	88,002 0	... ...	8
Oats.......	12,962 3	... ...	12,962 3	447 2	... ...	447 2	109,120 3	... ...	10
Rye........	... ...	... ...	... ...	... ...	... ...	... ...	163 7	... ...	
Pease	7,077 3	... ...	7,077 3	370 2	... ...	370 2	12,182 1	1,885 5	1
Beans.....	17.344 7	... ...	17,344 7	890 5	... ...	890 5	29,993 7	... ...	2
Totals,	159,874 0	619 4	160,493 4	2,624 2	3,341 5	5,965 7	1,463,965 1	4,757 5	1,46
May 5 1846.									
Wheat....	138,351 6	348 4	138,700 2	4,908 3	1,571 4	6,479 7	1,338.311 4	1,643 2	1,33
Barley....	5,478 2	305 2	5,784 1	513 7	... ...	513 7	92,266 6	306 2	9
Oats.......	21,987 3	... ...	21,987 3	1,939 5	... ...	1,939 5	127,473 2	... ...	12
Rye........	... ...	... ...	... ...	... ...	... ...	... ...	34 4	... ...	
Pease	4,153 7	... ...	4,163 7	176 4	250 3	426 7	16,711 6	1,635 4	1
Beans.....	26,005 5	... ...	26,006 5	1,916 6	... ...	1.916 6	58,803 7	... ...	5
Totals,	195,977 7	654 6	196,632 5	9,455 1	1,821 7	11,277 0	1,633,600 5	3.585 0	1,630
Feb. 5 1846.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt. qr. lb.	cwt
Flour	143,030 1 12	26,521 2 18	169,552 0 2	755 3 9	13,450 2 8	14,207 1 17	604,476 2 22	81,337 3 16	685,
Oatmeal..	... ...	... ...	... ...	... ...	... ...	... ...	160 2 10	2 3 16	
Totals,	143,030 1 12	26,521 2 18	169.552 0 2	755 3 9	13,450 2 8	14,207 1 17	604,637 1 4	81,340 3 4	685,
Mar. 5 1846.									
Flour	177,132 1 9	5,758 2 24	182.991 0 5	239 3 18	21,536 2 25	21,776 2 15	771,909 1 19	65,446 2 22	837,
Oatmeal..	507 2 0	... ...	507 2 0	... ...	... ...	... ...	668 3 18	2 3 16	(
Totals,	177,639 3 9	5,758 2 24	183,498 2 5	239 3 18	21,536 2 25	21,776 2 15	772 578 1 9	65,449 2 10	838,
Apr. 5 1846.									
Flour	121,263 3 2	5,516 2 9	126,780 1 11	1,325 0 17	27,690 2 7	29,015 2 24	897,613 1 10	43,258 1 14	940,
Oatmeal..	28 3 12	... ...	28 3 12	... ...	... ...	... ...	671 1 18	2 0 16	(
Totals,	121,292 2 14	5,516 2 9	126,809 0 23	1,325 0 17	27,690 2 7	29,015 2 24	898.284 3 0	43,260 2 2	941,
May 5 1846									
Flour	214,730 3 1	1,400 3 18	216,131 2 19	1,387 3 9	30,424 1 16	31,812 0 25	1,105,029 3 9	14,397 1 24	1,119,
Oatmeal..	328 1 8	... ...	328 1 8	... ...	... ...	... ...	999 2 18	2 3 16	1,(
Totals.	315,059 0 9	1,400 3 18	216,459 3 27	1,387 3 9	30,424 1 16	31,812 0 25	1,106,029 1 27	14,400 1 12	1,120,

[illegible] C.

Date, 184 .	LONDON. Per stone of 14 lb. Beef.	LONDON. Mutton.	LIVERPOOL. Per stone of 14 lb. Beef.	LIVERPOOL. Mutton.	MORPETH. Per stone of 14 lb. Beef.	MORPETH. Mutton.	EDINBURGH. Per stone of 14 lb. Beef.	EDINBURGH. Mutton.	GLASGOW. Per stone of 14 lb. Beef.	GLASGOW. Mutton.
Feb.	7/3 to 8/3	7/6 to 8/6	6/9 to 8/3	6/9 to 8/6	7/ to 7/9	7/ to 8/	6/3 to 7/6	6/ to 7/3	6/6 to 8/	6/6 to 8/
March	7/3 . 8/	7/ . 7/9	6/6 . 7/6	6/ . 8/	6/9 . 7/6	6/6 . 7/6	6/ . 7/3	6/ . 7/3	6/3 . 7/9	6/3 . 7/6
April	7/6 . 8/3	7/6 . 8/6	6/9 . 7/9	6/3 . 8/	6/6 . 7/6	6/6 . 7/9	6/3 . 7/6	6/6 . 7/6	6/6 . 7/9	6/6 . 7/9
May	7/6 . 8/	7/6 . 8/6	7/ . 8/	6/6 . 8/	6/6 . 7/9	6/6 . 8/	5/6 . 7/9	6/6 . 7/9	6/6 . 8/	6/6 . 8/

PRICES *of English and Scotch* WOOL.

ENGLISH, per 14 lb.	
Merino,	15s. 0d. to 20s. 6d.
.... in grease,	12s. 0d. ... 16s. 0d.
South down,	14s. 0d. ... 20s. 0d.
Half bred,	12s. 0d. ... 17s. 6d.
Leicester Hogg,	14s. 0d. ... 20s. 0d.
.... Ewe and Hogg,	12s. 6d. ... 17s. 0d.
Locks,	6s. 6d. ... 9s. 6d.
Moor,	6s. 0d. ... 8s. 0d.

SCOTCH, per 14 lb.	
Leicester Hogg,	14s. 6d. to 20s. 0d.
.... Ewe and Hogg,	11s. 0d. ... 15s. 6d.
Cheviot, white,	10s. 0d. ... 14s. 0d.
.... Laid, washed,	7s. 6d. ... 10s. 6d.
.... unwashed,	6s. 0d. ... 9s. 0d.
Moor, white,	5s. 6d. ... 7s. 6d.
.... Laid, washed,	4s. 0d. ... 0s. 0d.
.... unwashed.	3s. 3d. ... 5s. 0d.

THE REVENUE.

ABSTRACT of the Nett Produce of the Revenue of Great Britain, in the Quarters and Years ended on the 5th of April 1845, and 5th of April 1846—showing the Increase and Decrease on each head thereof.

	Quarters ending April 5.		Increase.	Decrease.	Years ending April 5.		Increase.	Decrease.
	1845.	1846.			1845.	1846.		
Customs	£4 402,506	£3,961,918	....	£440,588	£20,176,731	£17,664,618	....	£2,512,113
Excise	1 917,185	1,625,158	....	291,027	12,224,907	11,886,085	....	338,822
Stamps	1,742,461	1,685,868	....	56,593	6,714,840	7,095,521	£ 380,681	....
Taxes	145,945	146,142	£ 197	....	4,217,748	4,224,089	6,341	....
Post-Office ...	178,000	215.000	37,000	....	679.000	768,000	89,000	....
Miscellaneous	350,916	136,522	....	213,494	1,192,354	1,069,747	....	122,607
Property Tax	1,905,711	1,963,882	58,171	....	5,184,440	5,084,741	....	19,699
			95,368	1.001,702			476,022	2,993,241
	Ded. increase on Qr.		....	95,368	Deduct increase on Yr.		....	476,022
	Decrease on the Qr.		....	906,334	Decrease on the Year.		....	2,517,219

IARS PRICES *of the different* COUNTIES *of* SCOTLAND, *for Crop and Year* 1845, *by the Imperial Measure.*

ABERDEENSHIRE.

	Imp. qr.
Wheat, without fodder .	60/
—— with fodder . .	
Barley,* without fodder .	27/
—— with fodder . .	32/6
Bear, without fod. 23/6 to	27/
— with fodder 29/ to	32/6
Oats, First, without fodder	22 6
— First, with fodder .	28/3
— Second, without fod.	21/6
— Second, with fodder	27/3
Pease	30/
Beans	30/
Malt	
Oatmeal, per 140 lbs. .	18/6

ARGYLE.

Wheat, per bushel . .	6/1
Barley	3/10
Bear	3/5¾
Oats	3/1½
Beans	4/11¼
Oatmeal, per 140 lbs. .	20/10¼

AYR.

Wheat	47/10½
Barley	30/5¼
Bear	28/0¼
Oats	21/7¾
Pease and Beans . . .	41/7
Oatmeal, per 140 lbs. .	20/8

BANFF.

Wheat	54/3
Barley, without fodder .	27/7
——— with fodder . .	32/1
Bear, First, without fod.	25/
——— with fodder .	29/6
———, Sec., without fod.	21/9
——— with fodder .	26/3
Oats, Potato, without fod.	24/2
——— with fodder	29/8
— Com., without fod.	22/
——— with fodder .	27/6
Beans and Pease . . .	38/
Oatmeal, per 140 lbs. .	18/10

BERWICKSHIRE.

	Imp. qr.
Wheat	48/9¼
Barley, Merse	27/
——— Lammermuir . .	25/9
Oats, Merse	25/1
—— Lammermuir . .	25/1
Pease	30/8
Oatmeal, per 140 lbs. .	19/9½

BUTE.

Wheat	49/10
Barley	29/2½
Bear	25/9
Oats	26/3½
Beans	44/
Oatmeal, per 140 lbs. .	20/5

CAITHNESS.

Bear	21/7
Oats, Sandy	20/4
—— Hopeton	18/6
—— Dun	18/3
—— Black	16/
Oatmeal, per 140 lbs. .	18/2½

CLACKMANNAN.

Wheat	49/5½
Barley, Kerse	30/10½
——— Dryfield . . .	29/5½
Oats, Kerse	23/9
——— Dryfield	25/
Pease and Peans . . .	35/1
Malt	53/10
Oatmeal, per 140 lbs. .	21/0½

DUNBARTON.

Wheat	53/8
Barley	30/1
Bear	26/11
Oats	26/10
Pease and Beans . . .	43/7
Oatmeal, per 140 lbs.	21/11

DUMFRIES.

	Imp. qr.
Wheat	53/8
Barley	29/4
Bear	27/4
Oats, Potato	22/8
—— White	22/2
Pease	
Beans	40/2
Rye	34/
Malt	66/
Oatmeal, per 140 lbs. .	16/5½

EDINBURGH.

Wheat, First	44/10
——— Second	40/
Barley, First	30/6
——— Second	28/
——— Third	25/
Oats, First	26/8
—— Second	24/
Pease	40/4
Beans	40/4
Oatmeal, per 112 lbs. .	16/
Load, 280 lbs.	40/

ELGIN & MORAY.

Wheat	52/3
Barley	29/5
Oats	25/8
Pease and Beans . . .	41/1
Rye	30/
Oatmeal, per 112 lbs. .	16/11½

FIFESHIRE.

Wheat, White	24/10½ to	49/5¾
——— Red . .	23/10½ .	47/5¾
Barley . . .	20/9¾ .	28/4¼
Bear	19/4¼ .	26/4¼
Oats	17/9 .	24/2¼
Pease and Beans	18/11¼ .	36/
Rye	14/4 .	28/6
Malt, ...	40/¼ .	54/6¼
Oatmeal, 280 lbs.	20/2 .	40/3¼

FIARS PRICES.

FORFAR.

	Imp. qr.
Wheat	53/4
Barley	29/
Bear	26/11
Oats, Potato	24/4
—— Common	23/11
Pease and Beans	32/3
Rye	29/4
Oatmeal, per 140 lbs.	18/6

HADDINGTON.

Wheat, First,	59/9
—— Second	54/9½
—— Third	50/0½
Barley, First	37/6
—— Second	33/5½
—— Third	29/5
Oats, First	30/3¾
—— Second	28/4¾
—— Third	26/1½

INVERNESS.

Wheat, without fodder	51/5
with fodder	56/11
Barley, without fodder	27/7
with fodder	32/1
Bear, without fodder	23/6
with fodder	28/
Oats, without fodder	23/9
—— with fodder	29/9
Pease	
Beans	
Oatmeal, per 140 lbs.	21/5½
—— per 112 lbs.	17/2

KINCARDINE.

Wheat, without fodder	54/10
with fodder	61/10
Barley, without fodder	28/3¼
with fodder	33/3¼
Bear, without fodder	25/6¾
with fodde	30/6¾
Oats, Potato, without fod.	24/5½
with fodder	30/5½
White, without fod.	23/1½
with fodder	29/1½
Pease, without fodder	32/
with fodde	40/
Beans, without fodder	32/2
with fodder	40/2
Oatmeal, per 140 lbs.	18/6

KINROSS.

Wheat	37/
Barley, First	28/7
—— Seconc	25/7
Bear, First,	
—— Second	
Oats, White, Fir[illegible]	24/
—— Sec[illegible]	[illegible]
—— Black, Fir[illegible]	
—— —— Seco[illegible]	
Oatmeal, per 280 [illegible]	

KIR[illegible]

Wheat	
Barley	[illegible]
Oats, Pota[illegible]	[illegible]
—— Commo[illegible]	[illegible]
[illegible]	[illegible]

LANARK, (Continued.)

	Imp. qr.
Wheat, Second	43/5¼
—— Third	37/1½
Barley, First	31/7¾
—— Second	29/1½
Bear, First	28/6¾
—— Second	25/5¾
Oats, First	24/9¾
—— Second	23/6¾
—— Third	17/10¾
Pease	40/
Beans	46/
Malt	43/6
Oatmeal, per 140 lbs.	20/8½

LINLITHGOW.

Wheat	47/2
Barley	32/8
Bear	
Oats	26/1
Pease	38/
Malt	54/4
Oatmeal, per 140 lbs.	20/5
—— per 112 lbs.	16/5

NAIRNE.

Wheat	54/
Barley, without fodder	28/
—— with fodder	32/6
Oats, without fodder	25/
—— with fodder	31/
Oatmeal, per 112 lbs.	16/

ORKNEY.

Bear, per 334½ lbs.	13/10¼
Malt, 140 lbs. without duty	8/3 to 9/4
—— with duty	17/7
Meal, per 140 lbs.	13/

PEEBLES.

Wheat, First	
—— Second	39/10½
—— Third	
Barley, First	28/6¾
—— Second	26/0¾
—— Third	23/10
Oats, First,	25/6
—— Second	23/4¾
—— Third	21/6¼
Pease, First	
—— Second	40/4¾
—— Third	
Oatmeal, First, per 140 lbs.	20/10¾
—— Second	20/2
—— Third	19/11

PERTHSHIRE.

[illegible] First,	26/10 to	53/5
[illegible] Second	21/4	42/9
[illegible] First,	21/	28/9
Second	16/	22/
[illegible] First	17/6	24/
Second	15/6	21/2
[illegible] and Beans	16/6	33/1
[illegible]ye	13/1	26/3
[illegible] per 140 lbs.		19/1

[R]ENFREW.

[illegible]st	49/10¼
[illegible]	47/11½

RENFREW, (Continued.)

	Imp. qr.
Barley, First	32/2
—— Second	30/4¼
Bear, First	27/6¾
—— Second	27/1
Oats, First	26/3¾
—— Second	25/1
Beans, First	41/6
—— Second	37/2
Oatmeal, per 140 lbs.	20/10

ROSS AND CROMARTY.

Wheat	52/6¼
Barley	28/9¾
Bear	29/0½
Oats, First	25/2
—— Second	23/5
Pease	36/4
Oatmeal, per 140 lbs.	19/1½
Barleymeal	14/8

ROXBURGHSHIRE.

Wheat	50/0[illegible]
Barley	28/[illegible]
Oats	24/[illegible]
Rye	30/8
Pease	41/11[illegible]
Beans	36/11[illegible]
Oatmeal, per 140 lbs.	19/3 [illegible]

SELKIRK.

Wheat	46/
Barley	27/6
Oats, Potato	25/
—— Common	23/8
Pease	30/
Oatmeal, per 280 lbs.	40/6

STIRLING.

Wheat	42/
Barley, Kerse	30/9¼
—— Dryfield	29/9¾
Oats, Kerse	25/5¼
—— Dryfield	23/9¼
—— Muirland	19/4
Pease and Beans	37/
Malt	53/5¼
Oatmeal, per 140 lbs.	20/5

SUTHERLAND.

Wheat	
Barley	29/
Bear	26/
Oats	23/
Pease	30/
Beans	30/
Rye	28/
Oatmeal, per 140 lbs.	21/

WIGTONSHIRE.

Wheat	48/
Barley	29/2
Bear	26/6
Oats, Potato	22/4
—— Common	20/
Malt	64/
Rye	26/
Beans	33/2
Pease	
Oatmeal, per 280 lbs.	35/2
—— per stone	1/9[illegible]

[illegible]e may [illegible] Fiars Prices are the average prices of grain, as ascertained [illegible] year, by the verdict of Juries, in every county of Scotland. The Juries are summoned in spring, and [a]scertain, from the evidence produced to them, the average prices of the preceding crop. By these prices, [r]ents payable in grain, [illegible] contracts, are generally determined; but the main object is to convert [i]nto money the stipend [illegible] the most part fixed at a certain quantity of grain) of the Scottish Clergy.

ON THE ADVANTAGES OR DISADVANTAGES OF BREAKING UP GRASS LANDS.

By Mr THOMAS ROWLANDSON, Liverpool.

THE subject which heads this paper has ever been little understood, though undoubtedly the most interesting and important question pertaining to agriculture. The changes which have recently taken place with reference to the future protection of home-grown agricultural productions, have given this matter a degree of importance which will press the same with the most intense interest on the attention of all connected with agricultural pursuits. The subject is a difficult one, on which it was well said by the late Mr George Sinclair, in his invaluable work, the *Hortus Gramineus Woburnensis*, "that the comparative value of permanent pasture and tillage is a subject out of the reach of the humble narrator of facts; yet, after all, pasture land and tillage land are so mutually dependant on each other, and the community on both, that the question which of the two is the more valuable, and to be encouraged in preference to the other, for private or public advantage, can never receive an absolute answer; for the various local circumstances of soil and climate under which lands may be situated, also the fluctuations in the demand for particular farm-produce, caused by every temporary change in the political state of the country, make it impossible to obtain data on which to ground a clear and satisfactory answer to the question, and which shall be found to be correct under every circumstance." No man ever had, or perhaps ever will have, the opportunity of judging the relative properties of the different grasses equal to that possessed by Mr Sinclair. His work, already named, is the most valuable text-book on the subject extant. I may venture further to add, that it is immeasurably the most valuable practical work that has ever been published on agricultural subjects, and no farmer should be without having it in his possession. All that has been written respecting grasses, since its publication, and the various recipes given for the purpose of laying down land for permanent pasture, or alternate husbandry, have been copied from the work alluded to, or, with some slight alteration, (which is invariably for the worse,) made to hide the plagiarism. This essay is not intended for a dissertation on the grasses, the cultivation of which is inseparably connected with the subject. In order, however, to prevent long dissertations, when necessary, I shall refer at once to Mr Sinclair's or any other work for proof of what I may assert, but which I deem unnecessary here to dilate

upon; which would also have extended the paper to undue bounds, and probably have led the reader into confusion.

No plan occurred to me so well adapted to exemplify the subject, as a debit and credit account of the probable returns and expense of an acre of land during a series of years; also showing the relative cost of seed, labour, &c., distinguishing manual from animal labour. I have assumed 50s. per quarter as my data for the price of wheat, being firmly convinced that such will be about the price of wheat in consequence of the changes which have recently taken place in the Corn-laws. If too low, it will be obvious that the difference in value will be in favour of the alternate husbandry. On inferior soils, I have taken the average value of wheat at 2s. per quarter lower, viz., 48s. The estimated crops are probably higher than the average throughout the kingdom; nevertheless, they are crops obtainable on land such as is described. They are such as I and others have obtained, and can also be grown by any one without a very extraordinary outlay in manure. On exhausted lands, ruined by scourging cropping, the case is not applicable, as on such an extra outlay will be required. The land on which the following data are taken, is presumed to be in good heart, and is expected to be left so at the close of the rotation. The sum set down to each crop on account of manual labour, is assumed to be an average of the kingdom; each may probably find it somewhat different in his own district or peculiar circumstances. On examination, however, I believe it will be found a near approximation to the average amount paid in the *purely agricultural districts* of the kingdom. The most difficult part of the question has been the due apportionment of the respective values of green crops; for such I have no data on which to found an opinion which may emphatically be stated as correct. I have sought information by perusing a variety of agricultural reports, as well as several experiments instituted through the instrumentality of the Highland and Agricultural Society, but all are deficient on some one or other important point of information, which has left the matter *in statu quo*. By comparing the well-authenticated experiments alluded to, with each other, and adding thereto the results of my own experience, I am induced to think that the values of the various green crops, as herein set forth, are about their true worth to the farmer for home consumption, and nearly agree with their usual estimation amongst farmers. The grain crops are at the presumed market price, leaving only the straw for manure.

It is highly requisite that some data be taken on which the calculations relating to this subject are based. In doing so I have taken two data as my standards to reduce the respective values of green crops [illegible]. The first is by reducing the

feeding properties of different green crops to the value of hay as a standard. The second is calculated from the tolerably well-ascertained facts as regards the feeding powers of hay; the quantity of meat thus produced being valued at 6d. per lb., will reduce the various crops to a money, and therefore easier understood value. In districts where grass is plentiful, and where farmers not unfrequently fatten cattle on hay, it is found that a bullock of 50 stones weight will consume 40 lbs. of hay daily, and will put on flesh at the rate of 2 lbs. per day; valuing the meat at 6d. per lb., it would make the hay equal to L.2, 16s. per ton, besides the value of the manure. It is further found, that a bushel of potatoes, with 10 lbs. of hay, will produce the same result. This would make 5 stones of potatoes, or 70 lbs., equivalent in feeding properties to 30 lbs. of hay; at which rate 15 tons of potatoes would be equal to 14,400 lbs. of hay, or within 40 lbs. of 6 tons. I have valued a ton of potatoes as being worth L.1—15 tons as worth L.15. A ton of hay has been shown to be worth L.2, 16s.; it therefore follows that 15 tons of potatoes are equal in value to 6 tons of hay at 50s. per ton, and are consequently worth L.16, 16s., less 1s. 4d. for the 40 lbs. deficient of 6 tons weight, or 24s. 4d. per ton, for the sake of perspicuity. I have kept this, and will keep the remaining calculations as near as possible in whole numbers. I think it will be admitted that the basis of my calculation, as regards the value of potatoes, is correct, and will suffice to form a correct datum to proceed on, if the calculation as regards the value of hay is tenable. It must be remarked, that the hay now alluded to is the primest old meadow hay, which is known to possess much greater fattening qualities than that produced from seeds, clovers, or ordinary hay, on which account I have taken the average value of hay of all descriptions at L.2, 10s. per ton.

With respect to turnips, it is shown in the general report of Scotland, that 34 tons of common white turnips produced 436 lbs. of beef and tallow, which is nearly 13 lbs. per ton. It must, however, be remarked, that the feeding had been continued for five and a-half months without a succession of yellow and Swedish turnips, and as the white turnips would undoubtedly have lost a considerable portion of their nutritive qualities at the close of the feeding season, it was remarked that the experiment did not afford a fair average, and that 14 lbs. would be near the mark; at which ratio, 25 tons of turnips would produce 350 lbs. of beef and tallow, which, at 4½d. per lb., will be equal in money value to L.6 : 11 : 3, or 5s. 3d. per ton. I have only set them down in my calculation at 4s. per ton. It is an erroneous opinion, however, to suppose that the value of common turnips can be fairly estimated by their fattening properties. Their true value is, per-

haps, not set forth, either in the low estimate I have perhaps somewhat arbitrarily taken, or in that set forth in the previously detailed experiment. The true place of turnips (common) in the farm-yard, or in the field, is to rear lean stock—their containing a greater amount of the phosphate of lime than the Swedes, better adapts them to the growing wants of the cellular tissue of young stock; and, if eaten on the field, shearlings will, on the same account, thrive proportionally better. It is also well known, that an excess of watery food is apt to produce complaints of the bowels, which retards the little feeding properties they possess. It is, therefore, always expedient to give some dry nutritive food with this and all other descriptions of green crops. From these observations the reader will be convinced that my estimate of *the real* value of turnips is too low.

An experiment is detailed in vol. x. p. 266 of the Highland and Agricultural Society's Transactions, which was undertaken for the purpose of ascertaining the relative cost of feeding cattle on prepared or raw food; it was ascertained that the expense of putting on 1 lb. of live weight fed respectively on

		d.	
Raw turnips alone, was	.	$3\frac{1}{2}$	per lb. live weight.
Potatoes, do. ...	.	$4\frac{1}{4}$	do.
Potatoes and corn, ...	.	$3\frac{1}{8}$	do.

The above prices were calculated on Swedish turnips being worth 8s. per ton, potatoes 20s. per ton, oats 18s. and beans 24s. per quarter; the cost of fuel for preparing one half of the food consumed is included in the above prices, for which an allowance should be made, as it occasioned extra cost and trouble, the cattle eating more and thriving less in proportion on the prepared, than the raw food. In the above related experiment, the meat fed on turnips alone would cost $5\frac{3}{4}$d. dead weight, but if the calculation had been made on turnips at 10s. per ton, the cost would have come to 7d. per lb. dead weight. It must be remarked, however, that the inferiority of the half of the lot fed on raw turnips, is to be accounted for by the fact, that a heap of turnips from which they were fed had got tainted, and consequently they did not eat their ordinary quantity; in addition, it must be remembered, that the feeding on Swedes alone was not the most judicious mode of using them, as was well exemplified by the example of the difference in cost between cattle fed on potatoes alone and on potatoes and corn. I am, therefore, quite justified in assuming that Swedes eaten with good sound hay, or other dry and superior food, as corn, pea, or bean meal, are worth [illegible]0s. per ton, meat realising [illegible]d. per lb. In vol. xii. of the same

Transactions, page 66, it is shown that the cost of producing 1 lb. of live weight is

d.	
4.882	Fed on turnips, oats, linseed, and bean meal.
3.920	Another lot fed on similar food.
4.390	A third lot fed entirely on turnips.

It is worthy of remark, that the total improvement of each lot respectively was, during 17 weeks,—Lot 1st, 108 stones live weight; lot 2d, 101 stones; lot 3d, 49 stones. This also justifies me in setting forth the value of Swedes at 10s. per ton. As the experiment was only carried on for 17 weeks, the cost of putting on a pound of live weight is higher that it otherwise would have been, had the experiment been continued for three weeks (the usual time) longer; the quantity of meat put on during the last weeks of feeding greatly exceeds the amount put on during an equal time when first put up. The above related experiments are valuable on account of showing, that the most economical mode of consuming green crops is to combine them with drier and more nutritious food.

Having thus, though at some length, given the data on which are based the prices I have assumed for the purpose of calculation, I shall proceed to draw a comparison of the relative advantages and disadvantages of permanent grass lands, and the alternate husbandry. Before doing so, I may remark, I have assumed that meat will for the future realise an average of 6d. per pound dead weight, sinking the offal; good meat is higher than that at present, and I do not see any symptoms of its ever becoming lower. The introduction of Indian corn will greatly reduce the cost of raising meat by the means of green crops. An additional reason for taking meat as my standard of calculation is, that the major part of green crops will be eventually converted into meat; besides I am not in possession of data for ascertaining the relative value of consuming green crops and grain for the production of milk and its products. In the course of the following observations I take it for granted, that the greatest advantage of any system of farming to the public arises from the production, or conversion of productions into such as will return the highest money value per acre, valued either as raw produce or when converted into generally more valuable articles, such as cheese, meat, milk, butter, &c.,—the money test, being the surest and fairest, will produce the nearest average results. The farmer will deem that course the best which yields the greatest amount of profit with the least outlay of capital and labour, or that yields the largest net return for the capital

employed, and hazards undertaken. Judged in this manner, there are two classes of lands in the kingdom which will always yield the greatest amount of profit and rent by being in pasture. I allude to rich old grazing grounds, and excessively stiff clays, not of first-rate quality. As an example of the first I may mention the rich grazing lands of Lincolnshire; as the second, I may adduce such soils as the Oxford clay, noticed in the report of the implements in the last Number of the Royal English Agricultural Society's Journal, when the plough that was drawn as the easiest was obliged to have three oxen yoked to it. On stiff clays the disadvantages attendant on breaking up grass lands arise partly from the expense of working them, being at least double the amount of that arising from breaking up fair friable loams;—rains and heat are alike inimical to their working—the one converting the soil into paste or mortar, the other rendering it as hard as a brick, the chances of working such soils are precarious. Another disadvantage is, that stiff clays are not adapted to the growth of such crops as Swedes and potatoes. The only green crop suitable for clay land is rape, which, as it ought always to be eaten on the ground, tends, by the trampling of the animals' feet, to aggravate rather than lessen the evil arising from its over tenaciousness. Mr Pusey, in the last Number of the Royal English Agricultural Society's Journal, records having obtained on the Oxford clay a produce equal to 37¾ bushels of wheat per acre; dressed with 80 yards of burned clay, 45¾ bushels; similarly dressed and folded, 47½ bushels per acre. He states further, that dressing with 80 bushels of burned clay cost L.2, 5s. I presume a typographical error has occurred, cubic yards being meant, as it is scarcely possible that 80 bushels of burned clay would produce the fertilizing effects stated;* yet, on the other hand, 45s. per 80 yards of burned clay, including preparing, spreading, &c., appears only a small sum. The great fertilizing effects produced by the burned clay, doubtless arose from the quantity of the inorganic constituents of plants set free, particularly potash: further, in such a case, the quality of the soil would be improved permanently by converting a portion of it into something like the consistence of sand, and the dirty ochrous-coloured oxide of iron into the peroxide, both which substances are great amelioraters of stiff lands. The quantity of produce grown on clay lands is so precarious, and depending so much upon the nature of the season, that it is impossible to give data whereon to found any thing like correct estimates of the average produce of such soils; but estimating the produce of such lands, dressed as detailed by Mr Pusey, at 45 bushels per acre,

* Mr Pusey has since written to me to the effect that cubic yards are meant, not bushels.

and calculating the same as sold at the average price which I have taken as likely to be the future price of wheat, viz. 50s. per quarter, or 6s. 3d. per bushel, the produce would yield a gross return of L.14, 5s. per acre. The gross expenses of an acre so cultivated, together with the cost of preparing for and taking to market, marketing expenses, and commission, could not amount to less than L.7 : 0 : 7½, viz.:—

2½ Bushels of seed, at 6s. 3d. . . .	L.0	15	7½
Ploughing, harrowing, reaping, stacking, thrashing, marketing expenses, and including value of horse labour of every description, ...	4	0	0
Preparing burned clay, ...	2	5	0
	L.7	0	7½

To which has to be added the rent of the land. As the above charges are permanent, the deduction of the same from the gross value of the produce will leave the amount of profit derived from the operation. It, however, not unfrequently happens, through the effect of seasons, that the produce will not yield more than 24 bushels per acre, in which case the money value would only amount to L.7, 10s., which would scarcely repay the farmer for his outlay. Out of the expenses previously detailed, the labourer would perhaps benefit to the amount of L.3 : 5 : 6, of which sum I calculate, with what degree of correctness I am not enabled to say, that 30s. would be expended in labour in preparing, &c., the burned clay. To add to the receipts of the produce of the land, it may be said that the straw has not been taken into consideration. I admit it; but if it is reflected, that the crop of wheat has carried away a considerable portion of the valuable inorganic constituents of the soil, the straw left for manure will form but a poor compensation for the loss thus occasioned, as between the farmer and the labourer, the benefit of tilling such stiff soils is decidedly in favour of the labourer. The crop under question (wheat) is one calculated to yield the greatest money return, if as it usually is connected with the rotation—wheat, beans, wheat dressed, clover, and not unfrequently a fallow between the wheat and beans—the money return on the average in such cases will be considerably reduced; but what that amount will be, each will be able to judge from his own particular circumstances. As the cultivated crops, in contradistinction to pasturage, are uncertain on such soils in their yield, it becomes a question whether the latter will not yield a greater return to the farmer, the public, and the landlord. If under grass, I venture to assert that such would be the case. There cannot be a doubt but an

immense quantity of the stiff clays of England, which were broken up through the temptation of the high prices of grain towards the close of the late continental war, would have long since been laid down to pasture, for which they are better adapted, had not an obstacle prosented itself in the fact, that such lands are what is technically termed *difficult*, and are a long time of skinning over, after being broken up. That it takes years to obtain so valuable a sward on laying stiff soils down to grass after tillage, as it was when originally broken up, I am prepared to admit; but that an insurmountable objection occurs to laying down such, in consequence of not being so productive when so laid down as in tillage, I will not accede to; the real fault lies in the farmers' cupidity or ignorance. Let us, for example, take a field prepared in the manner shown by Mr Pusey, and sow the same with rape the latter end of June or beginning of July, the cost would be per acre as follows,—

Preparing burned clay, - -	L.2	5	0
Ploughing, harrowing and preparing land,	2	4	0
Seed, - - - - -	0	1	6
Total cost per acre, - -	L.4	10	6

Rape so sown on a field which was capable of producing in a good season 45 bushels of wheat, would grow so luxuriant that its value to be eaten off by sheep could not be less than L.7. per acre, thus yielding a profit of L.2:9:6 per acre on the rape, against L.7 : 3 : 9 on 45 bushels of wheat. It must, however, be remembered that the whole of the fertilising ingredients of the soil are left with the soiled rape crop, or at all events only a very small part is carried away in the increased amount of muscle and bone of the sheep, fat not carrying off any of the inorganic constituents of vegetables. The wheat crop may, through an adverse season, return only L.7, 10s., or a profit of only 19s. 4½d. per acre; the bean crop will not yield a greater return, and is also precarious; whilst the clover crop cannot be computed to yield more than 3 tons at 2 cuttings, at L.2, 10s. per ton, for home use, or L.7, 10s. per acre, less the cost of seed, mowing, making &c., in all say L.2, or a profit of L.5 per acre, independent of the dead loss sometimes arising from a fallow year occurring. The value of the extra manure required to keep the land in heart will reduce the profits arising from the tillage of clay lands, during an average course of six years, to a sum not equal to the profit set forth as returned by eating rape by sheep. The reason why farmers so repeatedly fail to obtain a luxuriant crop of grass from clay lands is twofold; first, they are never laid down but after exhausting corn crops frequently in a filthy state with weeds;

secondly, they are only sown with one or two kinds of grasses and clovers, instead of twelve or fourteen, and these only in one-third or fourth the quantity requisite to produce a permanent sward. On the first point it must be quite evident that it is peculiarly inappropriate to exhaust lands naturally *ill adapted to the early growth* of the ordinary cultivated grasses. Prior to sowing such soils with the intention of converting them into permanent pasture, it ought to be our object to put the land into the highest state of productiveness and tilth, so as to force the seedling grasses forward during their earliest stages; for herein only lies the difficulty, grass on clays, when once swarded over, being found to increase in value for years, and to eventually maintain their fertility when at the highest. The cause of this arises from the fact that clay lands are not easily permeated by the tender roots of seedling grasses; it is consequently expedient that they should be forced into maturity by the presence of an abundance of organic and inorganic manures; the plants thus absorb from the soil as much of these in one year as a dwarf herbage would in three, which is again returned to the soil by the droppings of cattle, and combining with decaying fibre, a greater abundance of which is formed than would have taken place if sown on impoverished land, speedily forms that description of surface soil known as sward, and which is esteemed so valuable. Grasses so grown and consumed on clay lands, increase annually in value, because at every year the surface soil becomes thicker, and consequently is more permeable for the plants to grow in, consisting in two or three years of matted roots combined with the decayed and decaying vegetable fibre of existing and pre-existing plants, added to the earthy top-dressing of the slow, silent, but sure-working earth-worm. Experience has shown that old pasture is superior in feeding properties to that newly laid down; the cause of which I venture to attribute to the fact that buds and young leaves contain a greater amount of potash than the matured parts of plants, which circumstance in the grasses adapts them peculiarly well for milk cattle and ewes suckling lambs whilst in the young state; as an exemplification, I may mention the flush of milk given by cows when put on eddishes, and the greater yield of milk given by ewes when put on Swedes or rape late in spring, when the tender seed-stalks just begin to shoot out—though these qualities are valuable, they retard the feeding properties. On the other hand, the more slow growing old grazing grounds possessing more gluten in proportion to their weight, gives them greater feeding powers, although the weight of vegetable fibre may absolutely be less. It is quite possible that Mr George Sinclair may be wrong in stating that land can be returned to pasture, and be as valuable in the course of three or four years as what it was previously to being broken up; that it

will nearly approximate to it is possible. The great supply of the inorganic constituents of plants existing in clay soils, which are being continually abstracted by the roots of old grasses, and are returned again to the soil by their decay or the droppings of cattle, amply supply the remaining grasses therewith, and compensate for the ordinary waste of inorganic constituents which may be taken away in bone, muscle, milk, &c. As regards the propriety of sowing a larger amount of seed than is usually done when laying down grass land, I shall quote the words of Mr Sinclair:—

The superiority of ancient natural pasture over those formed artificially with rye-grass and clover, was before alluded to.

It will be found principally to arise from the variety of different habits and properties which exist in a numerous combination of different species of grass. From the beginning of spring, till winter, there is not a month that is not the peculiar season in which one or more grasses attain to the greatest degree of perfection. Some grasses there are that withstand the injurious effects of long-continued dry weather better than others, and *vice versa*. Hence the comparative never-failing supply of nutritive herbage obtained from natural pastures, which it is vain to look for in those artificially formed with one or two grasses only. [He illustrates this by reference to turfs, a foot each, taken from rich pasture land belonging to the Duke of Bedford, from Endsleigh in Devonshire, but it is not necessary here to enumerate their names; he further adds,]—To those who are accustomed to consider as necessary one or two species of grass only, as rye-grass and clover, the fact of twenty-two different species of grasses and other plants being produced on something less than the space of a square foot of the best fattening pastures, would scarcely appear credible, unless it was thus demonstrated. The pasture, of which this turf is a specimen, on an average per acre, fattens one bullock of from 100 to 120 stones, Smithfield weight, and winters two sheep.—In the richest fattening pastures of Lincolnshire, which I have had an opportunity of examining minutely, and which were fully equal to fattening one large ox and four or five sheep per acre, the different species of plants were equally numerous on a given space of the ground, as in those rich pastures I examined in Devonshire; but, in the Lincolnshire pastures, the natural or proper grasses were in a much greater proportion, and, excepting yarrow and the clovers, there was scarcely a plant out of the family of the proper grasses.—The results of an examination of the rich fattening pastures of the Vale of Aylesbury, particularly those of Mr Westcar, at Creslow, were in perfect accordance with the above. [The following is most important]:—The proper quantity of grass seeds to sow per acre, is a point of the greatest importance, as regards the expense of the seed, and the speedy formation of the most valuable sward. The circumstances of soil, tilth, and weather, at the time of sowing, all influence in a great degree the successful vegetation of the seed. Should less seed be sown than is sufficient to furnish every part of the soil with plants of grass, a proportionate loss of time, labour, and land will be suffered. Minute vacancies of plants in a recently made pasture, or in a field of seedling grasses, may, to a general observer, appear insignificant, or escape observation altogether; but if these apparently minute deficiencies which occur over the surface of an acre be calculated, a difference, perhaps, of from ten to fifteen per cent in the produce will be found to exist between a perfectly furnished surface of land, and one where the deficiencies of plants are so minute as scarcely to be perceived. In the most productive natural pastures no deficiencies of plants are to be found, every part of the surface is closely interwoven with plants; and not as in pastures artificially formed of one or two species of grass only, where the surface is merely shaded [illegible] the foliage of the comparatively thin [illegible] plants

The last quoted remarks are important to all laying down land to pasture, but more particularly so on clay lands. The extracts are lengthy, but they are so pertinent to the subject that I could not resist the opportunity of inserting them, coming as they do from a person so thoroughly conversant with the subject. Another very powerful reason exists why a variety, and also a sufficient quantity of seed, should be sown, but particularly on clay land, viz., that a numerous amount of plants is more likely to shelter the soil from the scorching effects of hot weather, by occupying space which would otherwise be more exposed to its influence, besides greatly accelerating, for many reasons, the formation of sward. The following are the grasses best adapted to form permanent pasture ground on heavy clays, viz., timothy, cocksfoot—these two ought to form a considerable moiety—meadow fox-tail, fertile meadow grass, crested dog's-tail, perennial rye-grass, hard fescue, a small quantity of the *Agrostis stolonifera* or *fiorin*, the perennial white and red clovers, and of course others can be added; for various recipes I must refer to Sinclair. Respecting the mode of consuming the first crop of grass seeds, I incline to the opinion of Mr Sinclair, that they are best mown, when it is convenient. I should recommend mowing at least three times, and consuming the produce as green food; afterwards stock the same with shearlings, and in the following spring young neat cattle might be turned in if required; though it would be much better to pasture with sheep thereon for the first two or three years, turning young cattle on only during the day. Managing clay land in this way will no doubt be unfavourable to the labourer, but to the public, the landlord, and the farmer it would be beneficial: to the public it would be beneficial, as it would produce the greatest annual amount of produce at the smallest cost of labour, which might be beneficially employed in other channels; for a similar reason it would be beneficial to the occupier, besides enabling him to exercise his supervision over a greater extent of land; consequently a smaller proportion of profit would satisfy him, the difference of which would eventually find its way to the landlord, who would also be benefited in another way, viz.—when in grass, he would be perfectly secure that the tenant was not exhausting his soil. One great disadvantage that clay lands labour under is, their non-adaptation to the alternate husbandry, no green crop flourishing on them except rape. Thus the farmer cannot maintain the same quantity of stock in winter as in summer. The occupier of such soils might, however, venture to keep a small portion under tillage, commencing, if broken up from grass, with rape fed off, followed by beans, wheat, clover, or grass seed, broken up again the second year with rape, manured with bones or guano instead

of clover and mixed grass seeds. If not intended for permanent pasture, I should recommend 1 stone of timothy with 7 stones of red clover, and 5 stones of white clover, to be sown per acre, timothy yielding an enormous quantity of hay, very much relished by all kinds of stock, especially by working horses; it ought to be made into chaff, as in strong clays in good heart it will grow almost as coarse as straw. If one-sixth of a clay land farm were under a rotation such as described, it would yield the greatest amount of produce at the least cost of any other system; and as for winter food, there would be rape, timothy, and clover, hay, and bean haulm, with wheat straw for bedding.

I shall now enter upon the inquiry what would be the probable return of permanent pasture. On clays, laid down as described, a bullock would fatten from 40 stones to 60 stones of 14 lbs. dead weight, or 280 lbs. at 6d. = L.7; besides wintering two sheep to the acre. As this would be attended with little labour and expense, it is evident that the profit to the farmer will greatly preponderate by this system. I have not, in this case, taken any account of rent, as whatever that may be assumed to amount to, it will equally apply to both arable and pasture land. The calculations made previous, as well as all future ones as to the amount of crop, are based on the supposition that the lands have undergone a perfect system of drainage; on which point I may remark, that, in laying down clays to pasture, it is of much greater importance that the land should be drained in the first instance, rather than after being in grass for some time, as a partially porous soil eventually forms itself on all grass lands by the accumulated decay of vegetable fibre. Rich grazing lands, such as the celebrated Lincolnshire marshes, between Skegness and Wainfleet, are more profitable to the tenant, the landlord, and the public, in grass than in tillage, because land of the description now noticed will be equivalent to putting on 5 cwt. of meat per acre per annum, or 560 lbs. at 6d. per lb., = L.14 per annum; this land is about L.2 to L.2, 5s. per annum rent, with from 10s. to 15s. taxes. Presuming such land to be already under tillage, but in as good heart as when broken up, I assume will yield the following produce:—

Swedes, 30 tons per acre, at 10s.	.	L.15	0	0
Potatoes, 20 ... at 20s.	.	20	0	0
Wheat, 40 bushels, at 6s. 3d.	.	12	10	0
Clover, $2\frac{1}{2}$ tons, at 50s., L.6, 5s.; Eddish, L.1.		7	5	0
	4	L.54	15	0
		L.13	13	9

or 6s. 3d. per annum less than pasture; and if the rotation is carried further, the average annual return will be found less. The above rotation is founded on the assumption that the consumption of potatoes, wheat straw, and clover will produce a crop of Swedes, and the crop of Swedes eaten by sheep will again produce a crop of potatoes; if barley had followed Swedes, it could not be expected to produce more than 56 bushels at 3s. 6d. per bushel, which would only amount to L.9, 16s. We cannot, therefore, be surprised at the reluctance of farmers breaking up old grass lands of rich quality; but notwithstanding the advantages here set forth in favour of old pasture on rich land, the occupiers labour under one disadvantage, viz.—that a large portion of the stock has to be sold off in autumn, (some on highly favoured and early soils will manage to get beasts to market the latter end of July or beginning of August, when meat is at the highest), when prices are at the lowest, while purchases have to be made in spring, generally May, when stock is dearest. The profit of grazing such land as that just noticed would be very great had it not this drawback, viz.—the different value of cattle at the time of buying in and selling out, as it far from unfrequently occurs that the grazier has to give L.4 per head more for a beast at the time he purchases it, than its weight would amount to if valued at 6d. per lb. dead weight. It therefore becomes a question of primary importance to the occupier of rich grazing districts whether it would not be to his advantage to break up a small portion of his most inferior grazing ground, for the purpose of procuring winter food to rear stores to put on his richer grounds in summer; this point I am not able to answer.

Under the head of *good loams, meadow and grazing ground*, I include lands of the quality which will perhaps, on an average, be worth about L.1, 5s. rental, and 7s. 6d. taxes. Such soils as are now under consideration are used promiscuously for grazing to fatten, grazing for dairy purposes, and feeding stock, or, as in some places, under the alternate husbandry, they are the most kindly soils for tillage that we have; and though under favourable circumstances, in some places, a higher rent is given for this kind of land than even the richest grazing land, I have set the price previously named, because loamy soils are generally found in undulating counties, and considerable differences exist in the quality of land on the same farm; on the clays, fens, and wolds, the soil being generally of a more even quality. Land of the quality now under consideration will about summer graze one milch cow per acre, keeping her at the same time in good fair condition. A cow the year round will consume, in one form or another, the produce of three acres of this kind of land; and for such land, it is assuming a somewhat low average for a cow to yield 9 quarts

of milk per day for 280 days, or 2520 quarts, = 630 galls., which,

at $1\frac{1}{2}$d. per quart, will yield . .	L.15	15	0
Do. do. at $1\frac{1}{4}$d. do. . . .	13	2	6

According to some experiments related in the Farmer's Series of the Library of Useful Knowledge, it is shown that 100 gallons of new milk yield 112 lbs. of the best cheese, worth 6d. per lb., and 5 lbs. of whey butter; that 100 gallons milk made 34 lbs. of the best butter, and 74 lbs. of cheese of the worst quality, value 3d. per lb.; at which ratios, and they nearly agree with two other experiments which are related as having been madè for a similar purpose, viz.—to ascertain the most profitable mode of converting dairy produce into money—it would follow that 630 gallons

milk would yield		706 lbs. of cheese, at 6d. .	L.17	13	0
Do.	do.	$31\frac{1}{2}$ lbs. of whey butter, at 9d.	1	3	$5\frac{1}{2}$
			L.18	16	$5\frac{1}{2}$
Do.	do.	214 lbs. of butter, at 1s. .	L.10	14	0
Do.	do.	416 lbs. of cheese, at 3d. .	5	16	6
			16	10	6

It will be apparent to those generally acquainted with the different agricultural districts, that the extreme returns just stated cannot be obtained other than in particular districts. As the above experiments are related of parts of Gloucestershire, it is more than probable that they were made on richer land than that now under consideration. I think I may, under all the circumstances, fairly average the value of milk at $1\frac{1}{4}$d. per quart, which it certainly would be equal to, if we value butter at 13d. per lb., as per following calculation:—

214 lbs. butter, at 1s. 1d. .	L.11	11	10
630 gallons of sour milk, at 1d.	2	12	6
	L.14	4	4
630 gallons of new milk, at 5d.	L.13	2	6

A farthing a quart, or 1d. per gallon, may be thought too high a value for butter and sour milk to be used merely in feeding pigs; yet it ought really to be worth more, seeing that it contains three-fourth lb. of cheese. Sufficient is, however, stated to

show, that if butter averages from 1s. to 1s. 1d. per lb., and sour and buttermilk is properly used in feeding pigs, that 1¼d a quart for new milk will be somewhere about the correct average value. The account will then stand thus:—

A cow yielding 2520 quarts, at 1¼d. per quart, will amount to . . .				L.13	2	6
Expenses.—3 Acres of land, rent and taxes on do. at L.1 : 12 : 6 per acre,	L.4	17	6			
Expenses of making hay, straw, &c.	1	4	0			
				6	1	0
Net profit on the cow, .				L.7	1	0

But as the cow consumed the produce of 3 acres of land, that amount will have to be divided by three, or a profit of L.2, 7s. per acre.

Let us now examine the same land under tillage. It will produce of

Potatoes, 15 tons, at 20s. . .				L.15	0	0
Wheat, 32 bushels, at 6s. 3d. . .				10	0	0
Swedes, 20 tons, at 10s. . .				10	0	0
Barley, 40 bushels, at 3s. 6d. . .				7	0	0
Clover, 2 tons, L.5; Eddish, 15s. .				5	15	0
*Expenses.**—Rent and taxes on 5 acres, at 32s. 6d.	L.8	2	6			
2½ bushels of seed wheat, at 6s. 3d.	0	16	3			
Expenses of tillage of wheat crop, thrashing, and marketing expenses, including commission, .	2	19	0			
Seed potatoes, 110 stones, at 1½d.	0	13	9			
Ploughing, setting, digging, storing, &c. do.	1	10	0			
Turnips, preparing land, hoeing, weeding, seed, and carting manure, &c.	2	0	0			
Seed barley, 3 bushels, . .	0	10	6			
Tillage, and charges up to sale,	2	10	0			
Carry forward,	L.19	2	0	L.47	15	0

* All these calculations are based on the charges most likely to occur in England. How far they will agree with farming in Scotland, the writer cannot give an opinion.

Brought forward,	L.19	2	0		L.47	15	0
Clover seed, 10s., mowing, making hay, &c. . . .	1	10	0				
					20	12	0
				5	L.27	3	0
Average profit per acre, .					L.5	8	7

As the clover is presumed to be again broken up to grow potatoes, the sum set down may be assumed as the annual profit on the alternate husbandry, viz. L.5 : 8 : 7 per acre against L.2, 7s. on the grazing land, or a difference of L.3 : 1 : 7 per acre to the former, in favour of breaking up grass lands of this description; and the public will be advantaged by produce being obtained equal to L.9, 11s. per acre on the land in tillage, against L.4 : 7 : 6 on the pasture land, or more than double. Of the expenses laid out in manual labour, I estimate the amount as follows:—

The wheat crop, . .		L.1	17	6
The potato do. . .		2	0	0
The turnip do. . .		0	15	6
The barley do. . .		1	15	0
The clover do., 2 cuttings, .		1	0	0
	5	L.7	8	0
Average amount paid for labour per acre, ...		L.1	9	7

Presuming the cow used an acre of hay, and the small charge apportioned to her for attendance, &c., it would not amount to more than 12s., or 4s. per acre per annum for labour. In such a case, every party is interested in favour of the alternate husbandry; and a wise farmer will always have at least four-fifths of his farm under such a system of tillage—the landlord will receive a greater rent than when under grazing, and the public be benefited. In the course last noticed, the manure arising from the potatoes and wheat straw is applied to the turnips; turnips folded yield manure to the barley and clover, the clover and barley straw being applied to the potatoes. In theory, we need only return the same inorganic and organic materials that we remove from our fields or cultivated crops, to retain them in an

uniform state of fertility; but, in the rotation stated, it will be perceived that we remove in two crops, wheat and barley, a considerable portion of phosphate of lime and potash, and also nitrogen. Even, therefore, in the course set forth—and it is one less obnoxious to the charge of exhausting than any of the ordinary courses of husbandry—it will be perceived that each course will inevitably deteriorate the staple of the land; for, though nitrogen *might* in time be supplied from the atmosphere, the phosphate of lime, and other inorganic constituents, can only be replaced by a direct application. It is true that clay soils contain an abundance of potash, but such is not the case with sandy soils abounding with vegetable matter. Another reason for deterioration arises from the circumstance, that at least two-thirds of the organic and inorganic constituents of crops consumed by farming stock are wasted, the urine being allowed to run waste; and, from the want of proper precaution, a large amount of the valuable constituents of manure heaps is rendered soluble, and if not carried away by the rains which fall upon the heap, at all events will most certainly be so when applied to the field; and, to aggravate the matter, the valuable inorganic constituents of the heap so presented to the field are in a soluble form, which, instead of being of advantage, is the contrary. A simple expedient would prevent this in a great measure with the solid heap, whilst a tank would prevent a large amount of the waste from liquid manure. With every precaution, some waste will take place, both with the most careful management before application, as well as by the inevitable loss occasioned by some portion being carried off in solution by rains. The loss, however, on these grounds, together with that occasioned by the disposal of the two grain crops, would be replaced by bones and potash, or guano and potash, which could be purchased for 25s.; or 5s. per acre will be amply sufficient for the losses which are thus occasioned. In this calculation, it must be borne in mind, that the utmost care is taken both of the liquid as well as the solid manure, the due appropriation of the latter being also another important item. As neither of these requisites are attended to by ordinary farmers, we cannot be surprised at the results. Seeing that a supply of manure must be obtained somewhere, it becomes a question of moment in what way can these be obtained the cheapest. There are two ways only of doing so, viz. by direct purchase, or by buying oil-cake, Indian corn, pulse, or other more valuable feeding materials, and consuming the same in conjunction with green food, hay, straw, &c., by which means are obtained the inorganic, and some of the organic constituents of substances which have served to feed cattle, and thus repay the farmer for his outlay; and, as it has already been shown that the full value of the feed-

ing properties of green crops is only obtained when consumed in combination with more valuable feeding materials, it follows that, in this manner, the farmer may obtain a supply of the inorganic constituents without any cost whatever. Oh! but I fancy I hear a farmer say, Where's the capital to come from to do all this? My answer is, that if he has not sufficient capital to do this, he cannot properly manage his farm; and if he has 400 acres, let him part with 200, and if 200, let him part with 100, or until his capital is adequate to his farm. The explanations just given must be decisive with all thinking men as to the ruinous consequences of repeatedly growing grain and exhausting crops, whilst they at the same time exhibit the true *rationale* on which a correct system of husbandry ought to be founded.

With respect to the breaking up and tilling of down-land, there are fortunately on record the valuable opinions and facts of Mr Thomas Walkden and Lord Portman, which may be seen on reference to the 4th volume of the Royal English Agricultural Society's Journal, pages 80 and 81. The opinions given by Mr Thomas Walkden are particularly valuable, coming, as they do, from a gentleman who states that he farmed for twenty-six years on the North Wolds of Lincolnshire, and frequently visiting friends and relations who were agriculturists in Yorkshire and Nottinghamshire, and his present acquaintance with the south-west of England, by farming 400 acres of the lightest part of Salisbury Plain. It is not often that the public can be favoured with the opinions, backed by practice, of persons who have removed from the northern counties to the Downs of the south and west. The sentiments, therefore, of such a person as Mr Walkden are particularly valuable. The practice recommended by this gentleman to be pursued on down-lands precisely coincides with what I have already repeated as regards loams; and I venture to assert, that it will hold good with all lands whose quality shall be between stiff clay and very light hungry sands and gravels, viz. the cultivation of green crops in preference to corn crops. On this point, Mr Walkden admirably observes, that—

> To keep the greatest quantity of stock profitably, both winter and summer, should be the first object of every occupier of light land. Additional corn crops may make a greater return for a short period, but *eventually* will not reach the average profit of the system of cultivation which I have recommended, (*green crops*;) while to improve the condition of such land, by such means, would be in direct opposition to established facts.

On the course recommended by Mr Walkden is manuring with bones, &c., feeding with cake, &c., let us hear what he says—

> The farm I now occupy in the lightest part of Salisbury Plain, was taken in 1832, on a ten years' lease, at 24s. per acre, rent and tithe. The first crop was wheat, which, I believe, exceeded 4 quarters per acre. The next oats, which I ascertained to be nearly 8 quarters per acre. Then turnips, with- [illegible] except 1 quarte[illegible] per acre of bone-dust for the Swedes. The occu-

pier then left it, declaring that the land was exhausted, and would ruin any one to work out the lease. I ventured to undertake the farm for the remaining term; and for the first three years I certainly had the worst crops imaginable: wheat and barley little more than the seed again; oats about 4 quarters per acre, under 80 lbs. per bushel; grass seeds would not grow, the land was so light—indeed, such clouds of dust frequently blew from the land that sheep could not pasture near it. The improving state of the farm, from the turnip system and artificial grasses, fed green, is now apparent; 7 quarters per acre of oats are easily obtained, and of good quality. The present rent and tithe (though too high for the times) are 18s. per acre—at least four times their original value.

I presume the above land, when broken up from old down pasture, would produce in meat and wool the value of L.2, 10s., certainly not more than L.3 per acre, on which, of course, the labour employed would be trifling. I propose breaking it up in the following manner, viz.:—

			Value of Crop.		
Rape on the lea, eaten by sheep,			L.5	0	0
Potatoes, 10 tons, at L.1 per ton,			10	0	0
Wheat, 28 bushels, at 6s. 3d. per bushel,			8	15	0
Vetches, dunged and eaten by sheep, L.5; potatoes, L.10,			15	0	0
Wheat, 28 bushels, at 6s. 3d.			8	15	0
Clover, 1½ tons, L.3 : 7 : 6; eddish, 12s.			4	0	0
Clover grazed,			3	0	0
Potatoes manured,			10	0	0
Tares (eaten) L.5; rape ditto, L.5,			10	0	0
Grass, either as hay or fed off,			4	10	0
Or, on an average of 10 years, L.7, 18s. per year,			L.79	0	0
Expenses.—Rent and taxes on 10 years, at 30s. per acre,	L.15	0	0		
Seed wheat, 7 bushels, 6s. 3d.	2	3	9		
Rape seed,	0	3	0		
Seed vetches,	1	12	0		
Seed potatoes, 360 stones, at 1½d. per stone,	2	5	0		
Clover seed, 10s.; mowing, &c. 20s.	1	10	0		
Tillage of 3 acres of potatoes,	4	10	0		
Expenses of tilling rape,	2	0	0		
Ditto tares, L.1; expenses on wheat, L.5,	6	0	0		
Share of grass seeds, being 2s. per year for 10 years,	0	2	0		
				35	5	9
			L.43	14	3
Net amount of profit on a 10 years' rotation,			L.4	7	5

An *annual profit* greater than the whole value of the produce, prior to being broken up, on down-lands and others of the like light nature. It is very questionable whether long rotations are advantageous, as the firmness of such land in a great measure, if not wholly, depends upon the amount of vegetable fibre, which retains any manure or dressing better than the light soil otherwise would do. I rather think that a shorter course would be preferable; when, however, there exists sufficient aluminous matter, the loss will be of little consequence. As down-lands are light, it is evident that on such, and also on sandy soils, manures that are applied will rapidly be carried away by solution in rain water; or are what are technically called hungry soils, (they are so in a much greater degree than loams,) to supply which would perhaps entail an expense of from 5s. to 10s. per acre per annum; this sum would have, therefore, to be deducted from the profits. A shorter course might be as follows:—

Potatoes, 10 tons,				L.10	0	0
Wheat,				8	15	0
Vetches manured, L.5; potatoes, L.10,				15	0	0
Grass,				4	0	0
Or a produce of L.9 : 8 : 9 per annum,				L.37	15	0
Expenses.—Potatoe seed and tillage, L.4, 10s.; wheat ditto, L.3 : 11 : 10½,	L.8	1	10½			
Vetches, seed and tillage, L.2, 12s.; rape-seed, &c., 10s.	3	2	0			
Share of grass seeds,	0	2	0			
Ten years' rent and taxes, at 30s. per annum,	7	10	0			
				18	15	10½
			5	L.18	19	1½
				L.3	15	9½

The amount that would be spent on labour in the various croppings on down-land would probably amount to from 2s. to 3s. less than on that of good loam, the crops being lighter, and the land also easier to work.

The course here recommended for breaking up old leas, is different from that usually pursued, oats or wheat being generally taken; the most common course is to take a crop of oats. I am averse to both; oats, on account of the crop being of so little value, whilst it is extremely exhausting; wheat, because it is

particularly obnoxious to the wire worm on lea land, and in other respects is objectionable. It may appear strange to recommend rape and potatoes for the purpose, but I can assure the reader that it is the usual course pursued in the best potato growing districts in Lancashire and Cheshire, and is the almost universal practice in Ireland, excellent crops being obtained in this way; rape also grows well on lea. But I do not deem down-land adapted to rape; I should on such recommend potatoes to be taken. There is one crop better than all others adapted for lea, *provided* it is in fertile condition, viz. flax, which on down-land that would bring four quarters of wheat when broken up from the lea, would yield a crop of flax worth L.30, the charges on which, including rent and taxes, at 30s. per acre, would amount to about L.13, 10s., of which sum L.11, 10s. would be expended in labour. The growth of flax ought to be encouraged above all other descriptions of agricultural produce. As it cannot be profitably grown unless the ground is in good condition, both as regards cleanliness and heart, many landlords have prohibited its growth, under the impression that it is a highly impoverishing crop; yet it is not so impoverishing a crop as wheat, even if allowed to stand for seed; and if pulled in the white, is the least impoverishing crop that is sold off the farm. The water in which flax is retted should always be thrown on meadow or pasture land. There is a singular circumstance that peculiarly fits flax for cultivation on weak soils, such as downs and sandy soils, viz., that a crop of 38 stones is often more valuable than one of 70 stones; indeed, poor soils, with care and attention, will yield quite as good a return from the sale of flax fibre as richer lands, but poor soils will not bear its being so frequently grown. I shall, on the subject of flax, again quote Mr Walkden, with which quotation I shall nearly conclude the subject:—

I beg to give you another instance of down-land of a stronger and better description, being brought into the northern system of cultivation by Mr Brough of Shaw farm, near Marlborough. He has boned his land to a very considerable extent, and his turnips, thus managed, have invariably been a great crop. It is his opinion, that were the system of two corn crops in succession, and of mowing the seeds for hay instead of pasturing with sheep, done away with, the land would become more certain for turnips, particularly Swedes, than in the north. He has also grown linseed with success, for which he considers the *lightest of the downs* particularly adapted. He th s obtains a substitute for oil-cake—the carriage on which from London renders it very dear. Linseed is sown instead of barley or oats in spring. He has brought into cultivation the whole of his down pastures, and is enabled, by artificial grasses, to keep more sheep in summer, and much better than in its original state. But his greatest advantage is in the winter; a good turnip system, instead of hay, enabling him to provide food for many more sheep at a far less cost, as well as keeping them in a much higher state of condition. In short, the farm will bear comparison with the rich lands of the neighbourhood considered of twice the value.

When a flax crop is to be taken, the following course may be recommended. Flax on the lea; if pulled in the white, a crop of turnips taken the same year, fed off, followed by potatoes (if left for seed, wheat next); wheat after potatoes; clover hay, pasture, potatoes, tares and rape, pasture seeds. In this course, as well as all those precedingly related, potatoes can be replaced by Swedes if desirable. The courses recommended are not those usually pursued; to many they will doubtless appear Utopian, but I challenge any one to impeach their general accuracy. In so far as a subject so difficult to detail can be reduced to figures, I have no doubt but the crops on the light lands would in practice entail an expense of 5s. to 10s. per acre in purchasing bones, guano, &c. With that exception I believe the calculations are based on as fair averages as the subject is capable of being reduced to.

It will be seen, from all that has been stated, that stiff clays and rich grazing lands will pay the best in permanent pasture; that good working loams, down to sandy and poor down-land, not worth more than 12s. to 15s. per acre rent, are best in alternate husbandry; and their respective values as regards the alternate husbandry, gradually decreases as the land becomes poorer, until it reaches a point when their cultivation is no longer profitable. It is, however, uncertain whether it would not be profitable to break the poorest soils up once in about fifteen years, and till them for a period not exceeding three years, and then lay them down again in good heart. Whenever I allude to laying down land to pasture, I always mean that it should follow a crop of turnips or rape, soiled by sheep; in no other way will good permanent pasture be obtained in any thing like a moderate space of time. As an example of this system, I will detail the following instance of what was done on a farm in Holbeach Marsh thirty years ago. The field contained 25 acres, and 17 acres were sown with turnips and 8 acres with rape. In the month of August, six pecks of rye-grass were sown to the acre; at the beginning of November, the rape was consumed in the ordinary manner, turnips being folded; during the first week of the following March, 10 lbs. of white and 4 lbs. of red clover and trefoil per acre were sown; 250 sheep were bought at Boston market the 4th of May in the same year, and turned on to it; a fortnight afterwards, 250 more sheep were purchased, and turned in with the rest; the whole were disposed of at Smithfield by the end of August in the same year, the profit on which must have been very great, as the sheep, a cross between the Lincoln and Leicester, would clip 14 lbs. of wool per sheep. No corn crop would yield any thing like the same profit. In order to economical lay down grass land, it will of course be necessary for

the farmer to keep a sort of grass garden, as to obtain seeds in the quantity and of the quality desired, would cost to purchase the same from seedsmen 50s. to 60s. per acre. On this, as also the best description of grasses adapted to each sort of land, I must refer to Mr Sinclair's work, where the reader will obtain every information. The principle on which the course recommended to be pursued in this paper is that so pithily set forth by the celebrated Mr Bakewell of Dishley—"That the rearing and feeding of stock is the best mode of turning vegetable agricultural produce into money." I may add thereto, that growing too many grain crops is, like paper money, "strength in the beginning, but weakness in the end."

SOME FURTHER THOUGHTS ON SHELTER.

By Mr Donald Bain, Edinburgh.

I have often suggested shelter as a mean of improvement in Scotland, and I think there cannot be any doubt of its propriety, and even necessity. I have great pleasure in knowing that my suggestions have not been in vain, in so far as influencing the public *mind* is concerned. Many practical men of the first eminence, as well as writers upon agricultural subjects, have admitted, in the fullest manner, the soundness and importance of my suggestions; and have said that, combined with draining, shelter, such as I have pressed for, might raise the temperature of the country many degrees.

A writer in the Agricultural Journal, and a practical man, has said, "There can be no doubt that the forester and the farmer should now go hand in hand:" that is, that the planting of woods should now have a distinct reference to the sheltering of fields. Many writers in England and in Ireland have incidently praised the "Letters on Shelter," (as they are pleased to term these essays,) in the warmest manner. My impressions, fortified as I had endeavoured to make them, by the reasonings and examples of many agricultural observers, have been confirmed by what I believe will be considered the first of living authorities; namely, the deeply philosophical Liebig. In a paper which I had infinite pleasure in extracting from his writings, I shewed that warmth is equal to food, to a certain extent; and that there is nothing more exhausting than cold, nor more destructive to animal or vegetable. What he has now shown from reason and experience, others had shown from an experience unaccompanied by philosophical experiment or induction; and from both together, I think

the utility of shelter in Scotland, and in countries similar in climate, may be considered as settled. Many phenomena which neither had specially considered, may be held explained by the same reasoning. I shall only adduce one example. It has been recommended of late to cover pastures with straw, in the view of improving them, or bringing them more rapidly forward. It has been said, that the straw seemed to have the faculty of "*drawing up the grass*," such was the amazing improvement effected by thus covering it. The whole secret, doubtless is, the straw *shelters* the grass.

So convinced, at least, have practical men in Scotland become of the benefit of shelter, that in a meeting of the Inverness Farmer's Society, held at Inverness in October 1842, the president of the meeting delivered himself as follows. He was speaking on the subject of the improvement of sheep, and said:—"*The great matter to be attended to is shelter.* Even in Badenoch, and the colder and higher parts of the country, *were they to be guided by the directions laid down in Bain's treatise on that subject, in ten years they would be able to produce a race of cheviots, equal to those that now whiten the hills of Ross-shire.*"

I now therefore feel interested in establishing the soundness of these opinions, and bringing them into practice in a double manner; for the credit of those who have thought with me, as well as for my own credit, and the country's good.

But I sincerely believe that little reasoning is necessary. The great want is, to have the idea generally known, and impressed upon the few who can give it practical effect. These are landlords chiefly; but farmers also may be very useful in the matter; for if they should habitually press for shelter where it is wanted and would be useful, landlords would not long stand out. I shall, in the few following observations, therefore, venture to address myself to both; and both have a much deeper interest in the subject than I can have.

There is one consideration that I have not yet pressed, but I think it at least worthy of being tried; it is, that in looking at Scotland as it now is, unwooded, and consequently unsheltered, we are looking on a really *devastated country*, and which we should be ashamed to allow to remain in that state. I think it possible that some parts of the country may have risen higher than it was in times not even very remote; or, if it has not risen, the sea has receded: it was originally, doubtless, a series of islands. There is yet ample evidence that the space between the Forth and Clyde has been covered with water: the anchors of ships, and rings for mooring them, having been found in the carse of Falkirk, at a great distance from the present course of the Forth. The course of the Caledonian Canal has doubtless also, at one time divided

the kingdom still further; and the Dornoch and the Shin may have divided it again.

If these assumptions are correct, the land generally may have risen; and it may be, that we must account for the decay of wood in places known to have at one time abounded with it, by the change of the climate rather than the destruction of the wood. This might account for the circumstance, that in the moor of Corryarrick, (as, from want of more exact local knowledge, I have designated the range between Fort-Augustus and Laggan,) where I have seen the remains of an enormous oak, and which, I have inferred, did not stand alone, there is now no wood, not even a shrub, and

The heath-bird could not hide itself.

I believe firmly, that shelter being destroyed only in part, the barrenness might soon become general. I consider a blighting wind once let in, by the casual destruction of a natural barrier, quite equal to the destruction that appears to have overtaken this quarter, which, from certainly at one time sheltering numerous herds and their owners, is now not capable of sheltering any thing; being, though perhaps not wholly barren, yet certainly one of the barest heaths.

But though we might thus account for the change, I do not think it is necessary so to account for it. We all know, that the Romans, on visiting Scotland, found numerous woods. We know, also, that while these woods remained, they were so many fastnesses for the inhabitants, and rendered them indomitable. The Romans, therefore, and doubtless others, did in Scotland what the Russians are doing in Circassia now—*they destroyed the woods*; and, by that destruction, effected that of the cattle and people. They only conquered Scotland, so far as they did conquer it, by literally exterminating the people; but so far they did not exterminate them. It is to this policy and its consequences that Galgacus alludes in his speech recorded by Tacitus, before the battle of Blairgowrie, or, as it is termed, "of the Grampians:" —"*Solitudinem faciunt, pacem appellant!*"

They make a solitude, and call it peace!

The Scots, or rather the Celts, lost that battle; and the people retreated by the passes into Glenshee, &c., and doubtless opened up so much more of the country to the devastations of the enemy.

The wars between the Scots, or southern inhabitants of the country, and the Picts, or northerns, ending between Macbeth and the majority of the kingdom, and Malcolm Canmore assisted by the English, were doubtless attended by similar ravages: fire was the constant resort "on border and in glen." The death of

Macbeth at Lumphanan, probably saved the forests of Glentannar &c. But the habit has descended greatly lower, for even so late as 1746, many of the woods were burnt. The clergyman of one of the parishes in Argyllshire, while recording, in the very latest statistical accounts, that these mountains at one time bore pine "equal to the finest Baltic timber," and that "trunks of oak of prodigious size are also to be seen," records also, that in consequence of the transactions of 1745-6, "*persons but recently dead, remembered seeing the country one red ember!*"

Notwithstanding the recent improvements of this country, therefore, in many ways, we are really trifling with it; *we are living in a land that has been desolated, and not repairing that desolation!* Men who have heard of the misery of the clans of Scotland, and look at the condition of their country now, and congratulate the country generally on the change that has taken place, forget that they think of the clans, when broken down by conquest, thinned, dispersed, and almost extirpated; and not as they originally were, a great and gallant people—numerous, "well appointed," well supported, and even well and paternally governed. In like manner, those who now look at our woods, and think we are doing great things, in covering a few thousand acres with trees of no valuable description, planted without care, and prospering accordingly, forget that this country has at one time been covered with pine equal to the "Norwegian pine," and with oaks of the most majestic size. The pines are yet remembered, and in some places we are again recalling them; and of the oak it may be said, "*ubique scatet*,"—it is strewed everywhere; in every bog, and in every lake. It is the source of our enormous peat bogs, and most probably of our coals.

How really trivial, therefore, are the efforts we are making at improving this country! We are like persons scooping out for themselves small apartments and gardens amid the ruins of a once majestic edifice, instead of dreaming of restoring the great outlines of that edifice, in order to suitably occupying it again. The marks of cultivation far up on our hills are yet seen, and they are wondered at; but I think this is because they are not understood. I have no doubt that when that cultivation took place, the country was better wooded, and, consequently, much warmer than it has since been; and that the cultivation has ceased, at once from the destruction of the shelter, and of the people.

To what, then, should all these circumstances and reasonings lead, but to the restoration of our woods, or rather of proper shelters, upon a well considered and great and general plan? The mere covering of large tracts with wood, because we think they will grow nothing else, is nothing; or rather it is worse

than nothing, for it is doing mischief. It is creating woods, without regard to their greatest use, shelter; and it is probably occupying, in the least profitable manner, tracts that might be rendered of the utmost value. In planting enormous tracts, too, with no prospect of immediate profit, nor of great profit however remote, we are tempted to plant negligently; we are too apt to be satisfied with *merely planting*, and to consider that system the best, that enables us to "*stick in*" (for it deserves no other name) the greatest number of trees, in the shortest space and at the least expense.

It is, perhaps, now impossible to ascertain how the country was originally planted; whether by nature, or by inhabitants more careful and skilful than ourselves. We think agriculture was never understood before now; but the laws of our ancient kings and their "states," shame the lawgivers of England and Ireland at this day. The care of pastures and cattle must also have been considerable, or such a population as we know to have existed, could not have been maintained, and maintained in plenty, as the earliest travellers into Scotland, whose experience has been recorded, shows us. There are yet specimens extant of the noble animals fed in our forests, equal almost to the American buffaloes; while traditions are rife of the hunting of the boar, (the "Caledonian boar" appearing to have been the most formidable of the kind,) and of the deer and the roe. As early as Tacitus, the inhabitants of Scotland were not only organised into septs or clans, acting under their chiefs, as down to the latest times, but had their ornaments of silver even in battle; and there must have been considerable store of things useful and desireable in the country, or there neither would have been any thing to tempt the plunderers who were constantly assailing it, or to support the people after the plunderers were gone. I think this would not have been, had the country not been at least better sheltered than an endless succession of wars had left it, when what we deem authentic history begins; and I have little doubt that any one who will yet search into the economical history of the country, will be satisfied that I am correct.

But to what purpose is this urged? It is to satisfy us that, as I have said, we are not yet doing those great things we suppose; nor which are absolutely necessary, if we would do justice to the country. We are, in fact, in many things, *reversing* the policy that we ought to follow; and turning the country, for the pleasure of the English, into what was once threatened by their policy—a "hunting-ground." I have said early in these discussions, that *height* is not so much the cause of cold, as the want of shelter is: That in the highest hills, if there is a hollow or an artificial shelter, then there will be warmth and fertility more or less;

while in the lowest plain, if there is no shelter there will be no warmth, and nothing but barrenness. The reason of both is obvious. Without shelter the earth cannot retain the warmth imparted to it by the sun's rays, nor, consequently, nourish any plant requiring warmth, or genial moisture, for both are continually swept away. Nothing will grow in such circumstances but what can resist the scourging wind—that is, heath, or the wiry ling.

Again, I have also early said and shown, that wherever a shelter is, there there is warmth and verdure. It is what renders a valley more fertile than a hill.

But I have also said, that no ordinary rising ground, however useful, can yet impart that warmth that an artificial shelter, properly placed, can impart; because, over an ordinary rising ground, the wind passes unbroken, and even, to a great extent, descends into, and sweeps the valley. But a wood, or even a wall placed on a height, completely breaks the gale; and though bearing no proportion to the heights on which they are placed, will shelter better and further, than any natural swell can do.

Woods in particular, or rather strips of wood, properly placed, I have considered singularly appropriate as shelters; first, because they rise higher than any wall can do, not to be extravagant; and next, because they are much less expensive, because they are equally useful in themselves, as well as from affording shelter, as they are ornamental to the country; and, if they are properly planted, they may be said even to occupy *no space*, for I have shown that they may be made to improve as much *the ground they occupy*, for pasture, as they improve the ground they shelter, for every purpose.

Another of the clergymen of Argyllshire, after speaking of draining, as one of the most valuable improvements of the day, adds—"Plantations of wood should also be formed, as there are many eminences at present of little value, and assuredly of no beauty, which, if planted with oak, ash, or larch, the timbers most in demand for rural purposes, might, at a moderate expense, be rendered at once highly productive and extremely ornamental;" another, and perhaps unconscious testimony to the system I am recommending; and even this would be preferable to having the winds whistling round the bare hills, as it is melancholy to hear it doing at present, and blighting every thing into windlestraws. But this is not, in my opinion, all that should be done. In a country, limited as this is in point of extent, *every inch of soil is valuable.* I have therefore recommended, that even our hills should not be *wooded merely, for this were greatly to waste them;* they should, like the country generally, be *sheltered only by belts,* either circular or longitudinal, or both, in suitable circumstances, and at suitable distances, *to shelter and improve the portions con-*

sidered proper for pasture. I have recommended that these pastures should not only be sheltered, but, in proportion to their value and extent, drained and surface-ploughed; perhaps sown with perennial grasses, or even whins, broom, or whatever might shelter and feed animals. Contemplating a great increase of game, I have recommended that, in favourable places, crops should be sown for them, so as to render it unnecessary for them to prey upon the corn fields, or to stray from their own grounds. And, finally, that in the most remote spots, sheilings should be erected for shepherds and keepers, to enable them to superintend both the pastures and the animals feeding upon them.

And if this should be done in the mountains, how much more should it be done in the plains—in the spaces at present termed moors, &c.? *No particle of them should be lost!* They should be looked at from the first moment, either as pastures or corn-lands, not as the sites of woods; and no more planted than is absolutely necessary to render them available as pastures, &c., by duly sheltering them.

Neither should these shelters be *merely planted;* they should be planted with care. How disgraceful should it be considered to plant trees where they cannot possibly grow! where they must either be rotted by water, from the land being undrained, or starved or rooted up, from want of depth or nourishment in the soil. Yet these things are so common, as rather to be the rule than the exception.

I have mentioned, that in Belgium I have seen beautiful and valuable timber growing in morasses, and morasses, too, the character of which could not be changed, from the impossibility of sending off the water. But though the water could not be got rid of, it was drawn into ditches; the trees were planted as if, in lazy beds, and of course throve accordingly. More than this, there were, as I have also said, crops of potatoes growing under them. Very probably, for a change, there would be barley (to be cut for cattle,) vetches, or any other crops not requiring the sun; and every succession of these would benefit more and more both the ground and the timber.

In England too, on, I think, the Shap-fells, I gave instances of successful planting and sheltering, by planting the trees in zig-zag rows, at considerable distances, and so as to admit, in due time, that the ground under wood should be pasture. In this way *no space was lost.* On the contrary, the ground under wood was rendered six times more valuable for pasture than it had ever been before, independant of the value of the timber and shelter; and the value of the land enclosed and sheltered was increased in a yet greater ratio, for it was now fitted for every species of crop.

Were gentlemen to think of marking off their moors with such views as this, I think the following things would happen:—First, having less to plant, they would plant with more care; they would not only see that ample provision was made for the future growth of the tree, by thoroughly stirring the ground, breaking the moor-pan, &c., and taking care that if the ground were not drained, the tree should be planted where it would stand dry; but they would most probably drain, and even level the ground, however roughly, that if a better pasture should rise, it might have the surface entire.

Next, having taken such care of the space intended for shelter, they would certainly consider the space sheltered of more value. They would drain it; at least to a certain extent. They would probably remove large stones, or collections of stones, whins, broom, &c., if in the middle of a field. They might insert divisional lines of shelter, &c. &c. And, finally, seeing the ground more valuable as pasture, they might try if, by cultivation, portions might not be made more valuable still. In this way, even in fifteen or twenty years—and, consequently, within a period which most men even in middle life might hope to see—the face of the country might be greatly altered. Almost every spot in it might be made comparatively warm and fertile; much of it the seat of abundance, that is at present all but barren.

I will give an example. Blair-Athol, where the Queen lately resided, and which was doubtless a hunting-seat of our ancient monarchs when Dunkeld was their residence, is, as I understand it, a hollow valley, surrounded on all sides by hills at a considerable distance. It is at present, perhaps, tolerable as a summer residence, when no cold wind blows,—how much more romantic and *permanently warm* might it not be made, by clothing its hills systematically with woods, *particularly towards, and at the summits?* It would then, in summer, be positively warm; the most delicate flowers and even fruits might thrive—under shelter of the woods, indeed, but still in the open air; and though winter must come at last, it would certainly come later, inasmuch as all its *avant coureurs*, the winds, would be excluded; and it would be much milder, when at the fiercest, than it is at present, as every ray of the sun would be, as it were, hoarded and economised. What would be true of this valley, would of course be true of every other so treated; and, in short, however strange it may be, we seem not as yet to know how to treat the country we inhabit, so as to render it as comfortable as it might be, or of the greatest value.

I now count upon an auxiliary in this matter of the greatest value, and that is the railroad. That great social agent will render almost [illegible] some of the land valuable by bringing it

into easy and cheap communication with population and consumption. We have just learnt in time, too, that soil is, for the most part, merely of value as a matrix for plants, or for holding their food in solution; and that, with proper manures, and a proper degree of dryness and warmth, every soil may be made as valuable as another. The remote moor, therefore, and even the remote mountain, will scarcely any longer deserve the name. The owner may now visit any one quarter of the country almost as easily as another; and, what is yet more valuable and almost inappreciable, we may carry fuel and manure *to them*, or produce *from them*, as easily and almost as cheaply, as if the vicinage of towns and cities were universal.

That land hitherto remote, therefore, will rise in price, is little; the greatest consideration for the country is, that it will rise in *inherent value*. I would therefore advise landlords, certainly, to think of immediately bestirring themselves, as I have said, in sheltering their lands, and applotting and laying off their moors, both for shelter and for cultivation. If *they* shall not, it requires no great power of prophecy to foretell what will happen. Capitalists commonly so called, (for landlords *also* are capitalists to the full value of their lands), men who have made money by trade and enterprise of every description, will become landlords. *They* will not leave things as they find them, if the application of money or industry can do any good. *They* will plant, and drain, and grub, and manure, *till not an inch of their newly acquired territories shall lie useless*. *They* will do as I have recommended, I sincerely believe.

In the mean time, to such landlords as do not intend to change their position, and to whom these suggestions may be of value, I earnestly recommend them. Though they have occurred to a non-practical man, they may not therefore be the less useful. They have been suggested by careful observation, and they are sanctioned by every thought we can give the subject, as well as by every object we can look upon; and, duly followed out, they would, even in the days of mature men, make Scotland comparatively a garden.

To obviate the objection that may still be made—that *wood will not grow* where it is most wanted, I shall probably, in a future paper, show by undoubted testimony, that it *will grow;* that in times past *it has grown* in spots now deemed incapable of producing it; and, in short, that in lying by, as we have done so long, we have shown neither that patriotism, nor that discernment which we believe ourselves to have shown; and, consequently, that we should hasten now to retrieve our error, if we would avoid earning a character the opposite of both.

I would not say any thing severe, because I do not think it

merited. I think *oversight* is all with which we are as yet chargeable; but I do think that offering *præmia* for stock or crops, without having endeavoured to provide a climate for them, is like encouraging the use of elegant furniture in houses, *without having roofed in the house.* If this is true, it is very unnecessary to say that it is improper. The matter has only to be considered, and the practice I have recommended countenanced by influential landlords, or even by active and successful farmers, to make it fashionable and universal. Every body knows, that at one time, and even late in the history of the agriculture of this country, there were *no inclosures*, and, a little further back, no winter feeding! The landlords and farmers of those days were doubtless quite satisfied with themselves, as in France and Spain, and many other countries, they are still; but would any one in this country think well of a return to these? We are just as completely wanting to ourselves in Scotland, by omitting SHELTER as a system. The time will be, and it is not distant, when influential men and societies will be ashamed of having neglected this obvious improvement so long. They will wonder what could have blinded them to a thing so palpable; and consider all their attempts at improvement, while wanting this, as attempts neglecting one of the first elements of success; attempts to establish a garden in the open fields; or, as I have said, to embellish or render comfortable a dwelling, omitting the roof!

But I trust the oversight will be speedily seen and corrected, for it is of imminent importance. If not seen by us, it will certainly be by our successors, and little to our credit; and for this, among other things, I urge it so earnestly. But it is required from all circumstances: for the comfort of the animals we breed, of every description; from economy in feeding them—for warmth is equal to a large proportion of food, cold and fatigue are enormous wasters of food; and, above all, shelter is necessary *in this country* to the abundance and certainty of every species of crop; and if we would not absolutely busy ourselves in vain, or comparatively in vain, in raising crops which the first wind will blight, by inflicting a fatal disease, or, if not completely blight, yet thin and weaken them,—depriving us, therefore, of half the fruits of our labour directly, and rendering the other half imperfect, we will shelter our fields; we will shelter even our hills; for both require it beyond what we can conceive, because both, being properly treated, are capable of producing beyond what we can conceive.

I am astonished, in particular, that sportsmen, so eager for abundance of game, (if that is not a fashion more than an actual feeling,) should not desire to see our hills turned into *universal preserves*, abounding with pheasants and blackcock, and all the

noblest species of game, instead of being the barren and chance receptacles of a few of the minor species. Were a hill well wooded with trees bearing succulent tops and berries, with large interstices of pasture, studded also with bushes, or crops expressly destined for the game, how much more abundant must be the game!—how much more pleasureable the seeking it, amid warm woods, or cleared and levelled pastures, than among impassable swamps, or over barren heaths, yielding little game, and no other pleasure? *Even this is a consideration*, although the least, and therefore made the last: But as an accessory, and a pleasurable accessory of other and more important benefits, it is worth mentioning.

All circumstances therefore combine to enforce the propriety and necessity of *shelter*, if we would either show our patriotism or our intelligence. It is the characteristic of savages, and of savages only, that they leave their country as they find it; but *we* should deem it more ignorant still, to plant or sow without preparing the ground; and how much wiser is it to carefully prepare the ground, but wholly neglect the climate? Hardly the least. "*Gardez bien donc messieurs! ou vous serez sauvages et rien de plus*,"—as Napoleon said to his Marshals, when he saw them fighting *en Polisson!*

Seriously, we have done much less for this country than we ought to have done. We should remember that it forms a part of *the heart of a great empire;* and, consequently, that every foot's-breadth of its soil is precious, and every one of its people. But, to show ourselves merely *scientific agriculturists in Scotland*, —*we must shelter.*

THE FARMERS' NOTE-BOOK.—NO. XIII.

Electro-Culture of Crops. By J. TOWERS, Member of the Royal Agricultural Society of England, and London Horticultural Society, Professor of Agricultural Chemistry.—The late inestimable article on Electro-Culture from the pen of Mr William Sturgeon, which appeared in No. XII., New Series, of this Journal, claims the most serious attention. Far from desiring to supersede him in his attempt to accredit the cause he with so much skill and zeal undertook, it is my object to add force to what he has advanced. I therefore shall take the liberty to pass in cursory review the leading points of his article, and by appealing to the

authority of Dr Michael Faraday, of the Royal Institution, endeavour to elucidate the electric theory in general, so far as it may be possible, to induce the agricultural reader to give credence to the *reality* of that agent which abounds in every particle of matter throughout nature.

The late awful storms, and the tremendous manifestations of *that power* which all of us have recently witnessed, must strike the mind with assurance of the great fact, that electricity abounds in the air; and, under certain conditions, renders the watery vapour, which constitutes clouds, highly electrical. During the tremendous heats which prevailed from May 20 to August 1—heat which was of a dry character, with considerable density of the atmosphere—there were occasional transitions, wherein the air became sultry, oppressive, and vaporous. The first of these changes occurred with the summer solstice, when electric clouds formed, and some rain followed. Previous to this period, though the thermometer rose far above 80°, there had been no appearance of thunder clouds, or of evening lightning. The north or easterly winds had generally predominated; but with the 4th of July, and change of wind to S. and W., occurred the second sultry transition; and then, as too often has been the case of late years, on the 5th and 6th of July the land was visited by awful thunder, which introduced the usual rain of the season. These thunder storms are almost always succeeded by cool temperature, and so it happened in the present year. Again, the fine hot weather returned, and again the air became highly electrical and oppressive, followed on the 1st, 2d, 3d, and 5th of August by those fearful storms of thunder and hail, which appear to have visited every county of the kingdom.

We have thus proofs, ample and conclusive, that, by *solar influence* acting specifically upon the ground, the atmosphere becomes replete with that extraordinary power which we term *electricity.* Having thus generalised, I come, without further preface, to the consideration of Mr Sturgeon's Essay, which, as the writer assures us, was "undertaken for the sole purpose of stimulating farmers and other cultivators of the soil to pursue their inquiries in this important branch of research."

Passing by the greater part of the two first sections, pp. 263, 265, the latter of which recites several instructive experiments of philosophers at different periods, referring to the influence of *atmospheric electricity on vegetation;* but at the top of page 267, we meet the name of Mr Pine of Maidstone, which recalls to recollection a paper that appeared some years since, addressed to the Editor of the New London Mechanics' Register, signed T. P. I copied it entire for my Domestic Gardener's Manual, 2d edit. p. 311. believing that, according to the then existing state of science, [illegible] embodied nearly all that was understood on "*the*

Relation between Electricity and Vegetation." I now extract the most important passages verbatim.

The leading principles contained are,—that vegetation is continually extracting electric effluvium from the atmosphere, which is constantly, though in degrees materially differing, in a state of positive electricity; that the structure of vegetables, and their juices, are adapted to act with the greatest efficacy in imbibing the effluvium, and that it is highly probable they are indebted to its influence for their vitality. Vegetables abound in pointed terminations, communicating with juices passing through capillary tubes, and possessing strong conducting virtues, the inference is strongly confirmed by applying *vegetable points* to the extension or prime conductor of an electrical machine. For, though it be only the juices of vegetables which possess conducting virtues, this circumstance concentrates the action of electricity upon them; and its grasses, leaves, and other sharp and pointed extremities will be found to act with a peculiar activity in drawing off the effluvium. Few facts, indeed, are regarded as more fully established than that metallic points are the most efficacious instruments in abstracting electricity. This conclusion can only be accounted for from the circumstance, that the attention of philosophers seems not to have been directed to the action of living points; for, on applying a blade of fresh grass and a metallic point, either alternately or in conjunction to the electrized conductor, it will appear that the grass acts at a greater distance with more vigour than, and in preference to, the metal. The leaves of trees, and even their fine ramifications terminating in buds, and in general all the living pointed extremities, and the sharp and serrated edges of vegetation, will be found to possess the same energetic conducting qualities in proportion to their vigour, and the acuteness of their termination. Even a thorn or a thistle will vie with, if not excel, the sharpest needle in this property; and it may be observed that they are far better fitted to act upon the electricity of the atmosphere, as the deposition of moisture consequent to the withdrawing of the effluvium, which holds it in a state of vapour, so far from diminishing their conducting virtue, as in the case of metals, is the very principle of their nutrition; so that there is reason to conclude, that the acting of every point furnishes it at once with the means of its vitality, and its growth and maturation. A few blades of grass held towards the nob of a charged jar, the circuit being completed by the human body, will silently, but quickly, effect its discharge, without sensibly affecting the human frame. In short, every experiment upon the electric properties of the points and edges of vegetation, evinces their peculiar adaptation for imbibing electrical effluvium beyond that of any other known bodies.

Mr Sturgeon's 4th section is devoted to the consideration of *atmospheric* electricity (pp. 275–281); and to that the reader is referred in order to obtain conviction, upon very high authorities, that the air abounds with the subtile power so called, in a condition whereby it can be communicated to the earth through the media of metallic wires. He cites the experiments of M. Monnier in 1752; of L'Abbé Mezeas in 1753, and particularly those of the Father Beccaria in 1756–7, who says—" On the latter end of March 1756, I climbed the high and steep mountain of St Michael, and there I stretched and insulated several iron wires; one in the direction of the meridian of the monastery to the ruins of the *Sepulchre*, which was 1600 feet long." Other and very numerous trials were made, which are mentioned in *Beccaria's* work on "Atmospheric Electricity;" and the inference drawn from the whole is stated in the following words:—" Ever since I began to observe atmospheric electricity during *serene*

weather, the whole series of my observations has confirmed it to me, that this electricity is constantly of the *excessive* or positive kind."

We shall see hereafter the opinion on the positive and negative states and charges, recently formed by Professor Faraday; it will now suffice to show, that the atmosphere is generally in a state to warrant the hypothesis and experiments of Dr Forster of Findrassie.

Mr Sturgeon adduces the authority of Cavallo, the Rev. Abraham Bennet of Wirkworth, and of Mr Reid of Knightsbridge, from whom a striking quotation is given at p. 298.

Then follow the modern experiments of Mr Crosse, near Taunton; of MM. Biot and Gay Lussac, in 1804; a variety of interesting experiments by Mr Sturgeon himself; and finally, those conducted at Sandwich in 1840 by Mr Weeks, the results being equally grand and appalling.

Mr Sturgeon winds up his train of evidence thus—

I have been particularly solicitous in bringing these facts to the notice of electro-cultural farmers, in order to convince them that the apparatus about to be described is admirably adapted for conveying to the land immense quantities of the electric fluid when disturbed by lightning, or even by the presence of highly charged clouds; and that at other times, when no cloud is present, the apparatus is capable of supplying the soil with a greater quantity than it could otherwise receive from the contiguous dry air.

Having advanced proof sufficient to sustain the leading principle that the air contains electricity, which may be rendered available to man by the employment of adequate machinery, we will go back to section 3 of Mr Sturgeon's Essay, which treats of "The *Elementary Principles of Electricity* necessary to be understood by the Electro-culturist." And here the author enters somewhat at large upon the great principle of induction. It should appear that every substance in nature, and every *atom or particle* of that substance, is, according to its capacity, combined with, held together, or perhaps, in the case of gases or elastic uniform bodies, surrounded in all its particles by this elementary power. By referring to Dr Faraday's "*New Researches*," a striking view of electric induction may be obtained; but previously we find, according to Mr Sturgeon (p. 271)—

Whatever may be the quantity due to any individual object under ordinary circumstances, it becomes exquisitely susceptible of disturbance when the circumstances vary, and whether these be of natural or of artificial occurrence. A disturbance of the electric fluid in any body may be accomplished either by abstractions, additions, or by merely forcing a part of it to some particular side of the body operated on. In the first condition the body would be *electro-negative*, in the second *electro-positive*, and in the third *electro-polar*.

Without insisting upon, or indeed arguing for, the existence of two distinct electricities, I cannot entirely assent to this defini-

tion. If there be not *two powers*, there are at least two equal states or conditions of *one* great agent, the balance of which may be disturbed, and again restored to perfect equilibriun. Whatever may be said or thought, or apparently proved by experiments, of the *plus* and *minus* conditions of disturbed electricity—evidence which ought to be conclusive exists (notwithstanding admitted difficulties) to prove, even to demonstration, that two forces always are present, setting in one toward the other, like two darts that meet at a centre, or, to speak more correctly, that pass as from a centre outwards, in opposite directions. To exemplify this by a familiar experiment, which is open to any one:—It consists in sending a powerful shock from a charged Leyden jar through a card, when it may be distinctly perceived that the puncture made by the charge exhibits the *two* sides of the card forced *outwards*, just as if the puncture had been made by two points *at* and *through* the tissue of the card *from* its centre.

Dr Faraday has this remarkable passage at p. 518, 8vo edition, series 13 of the *New Researches*,—

No. 1627.—It is a most important part of the character of the current, and essentially connected with its very nature, that it is always the same. The two forces are every where in it. There is never one current of force, or one fluid only. Any one part of the current may, as respects the presence of the two forces there, be considered as precisely the same with any other part; and the numerous experiments which imply their possible separation, as well as the theoretical expressions which, being used daily, assume it, are, I think, in contradiction with facts, (511, &c.) It appears to me to be as impossible to assume a current of negative force alone, or the two at once, with any predominance of one over the other, as it is to give an absolute charge to matter.—(Refers to 516, 1169, 1177.)

There is another experiment which I have performed, perhaps fifty times, with a cylinder machine of greater power than is usually met with in private hands. The results were invariable, and at the time were to me conclusive of the theory of *two electricities* professing different characters, but attractive of, and perfectly neutralizing each other. Two jars of equal capacity were charged at the same moment by the same revolutions of the machine, by connecting the ball of the one with the ball fixed at the remote end of the prime conductor—and the other with the ball of the cushion conductor—(for the machine was furnished with both—the one producing *positive*, the other at the back of the rubber, *negative* power.) The quadrant electrometer and pith-ball guage, proved the charge of each jar to be real, although the advocates of the Franklinean hypothesis presume that the jar at the rubber end was emptied or discharged, and brought to the minus condition. Removing the jars, and placing both on an insulating stand, a pith-ball suspended by a dry thread of silk, was made to approach the knob of *each* jar—it was at first at-

tracted equally by one as by the other, and then immediately repelled, revolving round the knob as in an orbit several inches distant from it. If the ball employed for one jar, so revolving, were made to approach the other, it was again attracted and subsequently repelled. Again, if the jars were brought so near to each other, as to permit a neutral suspended ball to reach the two knobs, and be placed within the sphere of attraction of either jar, (no matter which,) it was drawn to the knob, then repelled from it, and instantly attracted by the knob of the other; thus passing in successive alternations from one to the other, till it gradually neutralized the condition of each. Finally, a strip of tin-foil was placed under the two jars; thus they were connected together by their outside tin-foil coatings: a jointed discharger, with double knobs, and insulating glass handle, was then made to approach each knob of the jars; and when at striking distance, the circuit being thus completed, explosion took place, and the electrical tension vanished—or, to employ conventional language, the two jars were discharged between knob and knob, as completely as any single charged jar would have been by forming the circuit between its coating and knob.

It is evident, from the undeniable facts thus appealed to, that each Leyden jar was in an electrized condition, both producing similar phenomena, but in alternate order; the one attracting what the other repelled: the phenomena of both were sensible and visible; it would be futile to say that the one was empty or *minus*, the other charged or *plus*. If both were electrized—or charged—how had they become electrized, and what the charge? The questions are the more pertinent, inasmuch as precisely corresponding phenomena are induced, when one of the jars receives a charge by its knob, which conducts to the *inside* coating, while the other shall be charged by presenting its *outside* tin coating to the *same* conductor, the jar being first placed upon an insulating stool, the knob being connected with the earth by means of a chain or wire. If *one* conductor, therefore, can produce *two* different conditions of charge, by merely operating upon the *inside* coating of one jar, and upon the *outside* coating of the other, can we by possibility suppose that electricity is a *single power?* Dr Faraday says, at No. 1176:—

Evolution by friction gives both powers in equal proportion: So does evolution by chemical action, notwithstanding the great diversity of bodies which may be employed, and the enormous quantity of electricity which can in this manner be evolved. The more promising cases of change of state, whether by evaporation, friction, or the reverse processes, still give both forms of power in *equal* proportions; and the splitting of mica and other crystals, the breaking of sulphur, &c., are subject to the same law of limitation.

(1177.) As far as experiment has proceeded, it appears therefore impossible either to evolve or make disappear one electric force without equal and corresponding change in the other. It is also equally impossible, experimentally, to

charge a portion of matter with one electric force independently of the other. Charge always implies induction, for it can in no instance be effected without; and also the presence of the *two* forms of power, equally at the moment of the development, and afterwards. There is no *absolute* charge of matter with one fluid; no latency of a *single* electricity. This, though a negative result, is an exceedingly important one, being probably the consequence of a natural impossibility, which will become clear to us when we understand the true condition and theory of the electric power.

(1178.) The preceding considerations already point to the following conclusions: bodies cannot be charged absolutely, but only relatively, and by a principle which is the same with that of induction. All *charge* is sustained by induction. All phenomena of *intensity* include the principle of induction. All *excitation* is dependent on, or directly related to induction. All *currents* involve previous intensity, and therefore previous induction. Induction appears to be the essential function both in the first development and the consequent phenomena of electricity.

With these leading principles, as now advocated by our great philosopher, we may elucidate in a few words the action and effects of simple induction. Suspend from a rod of dry wood two small brass, or gilt pith-balls, by threads of silk of equal length. Excite by strong friction of a dry and white silk handkerchief, a glass tube of an inch diameter, solid, and rounded off at one end. Let the excited tube be brought opposite to one of the balls on the same line with the other which is more remote: the positive electricity of the tube will *induce* disturbance, attract the *negative* electricity of the first ball, and bring it to the side next in face of it, while at the same moment the opposite side of the ball, that most remote from the tube, will be brought into the *positive* condition; this first ball will also act upon the other ball, and induce similar conditions; so that if a third, and much smaller pith-ball, be held by a thread exactly between the two others, it will—provided the distance be not too great—travel between them so long as the electric excitation is kept up. Balls, or any other forms of matter, thus treated, become *polar*, one to the other; and the action by which they are so polarized, is termed *induction*, because two opposite states, each attractive of the other, have been *induced* by the exciting electric.

I now return to Mr Sturgeon's essay, with a view to introduce a striking circumstance, worthy of rigid inquiry and observation. He says—

The various objects which constitute the vegetable clothing of the land are never in precisely the same electric condition, being continually *positive* and *negative* with regard to each other. An oak and an ash tree, for instance, though both in their ordinary or normal electric states, are not endowed with the same degree of electric force, one being positive to the other, and consequently, the latter *negative* to the former.

This mention of the *oak and the ash*, and their opposite electric states, (which latter implies of necessity a *polar* condition of both, induced by a specific condition of the atmosphere,) involve the question of *how far* these *trees*, at the period when they develop

their foliage, may be considered indexes of the succeeding summer. Many persons have taken notes of the spring state of the trees, and certain provincial papers have given publicity to such observations.

It has been thus stated, that if the leaves of the oak appear much in advance of the ash leaves, the succeeding summer will be warm and dry. On the contrary, the earlier development of the ash foliage may be taken as a prognostic of a moist summer, while a simultaneous leafing affords promise of a changeable state of the weather.

In 1844, the oaks had the start, the spring was fine, the summer early, and generally hot; crops were carried early; but so severe was the drought from the first week of April, that little or no hay was made, and green fodder failed. In the present year, March and April were wet and cold, so that fears were entertained of a bad early summer; still, in that state of weather, the *oaks* were *more* than *usually early*—in many instances above four weeks in advance of the ash trees. On the 20th of May fine weather was confirmed, with great and advancing heat, which lasted, with few intermissions, till the storms of July 6 and August 1st. So severe was the drought in Berkshire, that the rains which fell during nine weeks had not really moistened the ground to the depth of five inches. On the whole, the average temperature was four or five degrees in excess to the 10th of August. It may then be said with truth, that since the commencement of dry weather in May, about the period when the ash trees had fairly put on their green clothing, the summer has been generally dry and unwontedly hot.

Could it be substantiated upon decisive evidence that the comparative spring position of the two trees furnishes a trust-worthy indication of the future summer, we might satisfy ourselves that the electro-polar condition of either tree was dependent upon a specific electric state of the atmosphere; and hence be enabled, philosophically, to account for phenomena which it were superstitious folly to refer to blind prognostic. The subject is undoubtedly worthy of attention on the part of those who take meteorological observations, and note them down.

There remains much choice matter in the whole of Mr Sturgeon's third section, which there is not now space to notice, and must pass on to section 5, which treats *practically* of electro-culture.

Before the writer alludes to the experiments of Dr Forster, he says, p. 284—

There is every probability before us, and not even a suspicion left to the contrary, that the grand stimulus of vegetable life is the electric fluid, under which impression we are forced to acknowledge that agent to be as essential to

the welfare of plants as either rain or manure; for independently of a stimulating force, neither manure, rain, nor soil, could lend even the remotest aid in propagating vegetable structures.

These are opinions, which I have advocated for years, and in which I entirely coincide. Decomposition of manures is essential to growth; decomposition is a chemical process—and all chemical action is strictly electrical. I am happy to cite the authority of Dr Faraday, as I find it in No. 1161 of his *New Researches*, as it appears to me to add weight to the above theory, while it instructs the inquirer.

The science of electricity is in that state in which every part of it requires experimental investigation; not merely for the discovery of new effects, but what is just now of far more importance, the development of the means by which the old effects are produced, and the consequent more accurate determination of the first principles of action of the most extraordinary and universal power in nature:—and to those philosophers who pursue the inquiry zealously, yet cautiously, combining experiment with analogy, suspicious of their preconceived notions, paying more respect to a fact than a theory, not too hasty to generalize; and, above all things, willing at every step to cross-examine their own opinions, both by reason and experiment, no branch of knowledge can afford so fine and ready a field for discovery as this. Such is most abundantly shown to be the case by the progress which electricity has made in the last thirty years. Chemistry and magnetism have successively acknowledged its ruling influence; and it is probable that every effect depending upon the powers of inorganic matter, and perhaps most of those related to vegetable and animal life, will ultimately be found subordinate to it.—(p. 360.)

Dr Forster's mechanism with the view to distribute electricity throughout an oblong surface of land, is described by Mr Sturgeon at page 283, where two wood-cuts are given—fig. 4, to exhibit the radiation of electricity when passing through metallic wires—and fig. 5, the *position* of the underground wires adopted at Findrassie.

As it may be satisfactory to the reader to become acquainted with some particulars connected with these experiments, I take the liberty to present an extract from a letter written to me by Dr Forster, subsequent to the communications which were made public in 1844. His words are—

The buried wires should be as straight as they may conveniently be placed; it is not so important, in my opinion, that they should be magnetically due north and south, although mine were, and are; but the suspended wire *must* be so; therefore the two buried wires on the east and west sides of it, should necessarily (if not parallel to the suspended wire or wires) be of equal lengths.

The rule for the height of the suspended wire is 8 to 10 feet above the utmost probable height of the plants, where one wire is employed; and if more, each three feet above the one beneath it. My wire of a small plot, will not, on some occasions, just before sunrise, deflect the needle 10 degrees—in an hour 90 degrees; this I often observe in clear weather. In cloudy mornings, if cool, it will be 10 or 12 o'clock before the needle is deflected 90 degrees; many other facts I have noted tending to this opinion.

Connected with the length of the poles, Mr Sturgeon, at p.

284, mentions the loss of colour in a plot of barley over which the suspended wire was raised by poles 4 feet high: this loss of verdure was evidently owing to the *attraction exerted by the pointed terminations of the barley*—they had superseded the wire, and put it out of office: Dr Forster (for the experiment was *his*), therefore, had "fixed to each pole a piece of dry pine, 8 feet high, and suspended two wires to them, one at that elevation, and another a foot lower down, and was pleased to find that, after some time, this plot *partially resumed its former dark green colour*, which it had previously lost."

Mr Sturgeon proceeds to describe the several experimental trials he undertook, and gives drawings of the modifications of the wire apparatus employed by him; to these the reader is referred—with the account of the results—at pp. 284–8, and section 6, 288 to 294. Section 7 consists of concluding *Remarks*, with *Practical Rules for future Experiments.*

It should appear that Dr Forster's arrangement of the strained wire, in the direction of the magnetic meridian, as indicated by the compass needle, was adopted in consequence of a theory which is ascribed to M. Ampere, a French philosopher, who, in attempting to account for the earth's magnetism, supposed that there was a continuous flow of electric fluid round the axis, from east to west.

Mr Sturgeon questions the accuracy of the hypothesis, and the existence of any such currents. The magnetism of the earth itself—in its ordinary acceptation—as supposing the earth to be a magnet, is more than doubtful; for, as electricity itself must be referred to the *sun*, either as its *direct fountain*, or by its influence upon the surface of the earth, as producing those disturbances of the *power* which we call electricity—so magnetism may depend altogether upon these disturbances, operating in a way, and by means, which as yet remain profound mysteries.

Faraday, at Series II., No. 191, has the following remarks on terrestrial currents:—

> Though positive results have not yet been obtained by the action of the earth upon water and aqueous fluids, yet as the experiments are very limited in their extent, and as such fluids do yield the current by artificial magnets, (for transference of the current is proof that it may be produced,) the supposition that the earth produces these induced currents within itself, in consequence of its diurnal rotation, is still probable; and when it is considered that the moving masses extend for thousands of miles across the magnetic curves, cutting them in various directions within its mass as well as at the surface, it is possible the electricity may rise to a considerable intensity.

Dr Forster, as we have seen, insists upon the necessity of placing the cross or stretched wire in the line of the magnetic north—that is, at some degrees west of the north pole, according to the existing variation of the compass; but Mr Sturgeon, seeing

"no reason to believe that a continuous electric tide in the air sweeps the surface of the land from east to west, nor any means, at our disposal, of confining electric influences within the limits of a marginal wire in the ground," says, that "there is no authority, from facts, for making choice of the magnetic meridian;" and, therefore, proposes several improved modifications, or arrangements, of *copper wires*, as being of superior conducting powers, and less liable to chemical action than iron." He also says that, as the prevailing winds are, in most parts of Britain, easterly in the spring, and westerly during most part of the summer, he would propose to stretch a pair of wires from N.E. to S.W., and another pair above or beneath, crossing them at right angles. I refer the reader to the descriptions and plans at 295–6, and shall confine what further remains to be said to the consideration of the manner in which atmospheric electricity may, upon philosophical principles, be presumed to affect the soil, and the roots of plants growing within it.

It has been shown that the air is an electric, while it remains dry and dense; consequently that it must, of necessity, act upon, and polarise, the moist vegetable tissues which are in a growing state. Mr Forster's experiments with iron wires, stretched over poles of different heights, connected with others buried three inches deep in the soil, and enclosing areas of land, were found to fail, or at least to become inefficient, when tall-growing plants—as of wheat or barley—attained height enough to attract the electricity, which might, perhaps, have passed through the wires; and to have recovered verdure when the said wires were elevated several feet above their first position. That wires so arranged occasionally give forth sharp, pungent sparks, I have been assured by the report of men who were employed to put them up; and that the compass needle has been deflected when suspended over the pole wires, has been attested by Dr Forster. Now, admitting the force of such evidences, we would inquire in what manner electricity, thus conveyed to the ground, can act upon it so as to stimulate the vegetable organism and promote the formation of sap by the more rapid decomposition and laboration of manure.

I believe, with Dr Faraday, that they imbue every atom or ultimate particle of matter, and, when stimulated, polarise it, conferring upon the said particles a double power, which, in the current, moves in opposite directions with inconceivable activity, and communicates the same powers and movements to the particles of every conducting substance within the sphere of their influence. Thus, then, when wires are stretched above crops, and conducted down to a system of under-ground wires, arranged according to Mr Sturgeon's newly proposed modifications, what-

ever electricity, with its *transverse* electro-magnetic radiations, may pervade the elevated wire, will act *throughout* its particles, and induce similar phenomena in every portion or branch of the system buried under ground; and thence proceeding outwardly, will act upon the moist particles of manure and earth about and among the roots. This latter action is strictly electro-chemical, being precisely representative of that which a living plant, electrized by the atmosphere, exerts *individually* by its branching series of roots and rootlets, upon the decomposable substances adapted to its nutrition.

A good deal has already been said of induction and polarization; but in order to render the theory still more clear, I must, in justice to its advocate, appeal once more to the *New Researches*. Thus, at p. 362, No. 1165, the author says—

> At present, I believe ordinary induction in all cases to be an action of *contiguous particles*, consisting in a species of polarity, instead of being an action of either particles or masses at sensible distances; and if this be true, the distinction and establishment of such a truth must be of the greatest consequence to our further progress in the investigation of the nature of electric forces. The linked condition of electrical induction with chemical decomposition; of voltaic excitement with chemical action; the transfer of the elements in an electrotype; the original cause of excitement in all cases; the nature and relation of conduction and insulation; of the direct and lateral or transverse action constituting electricity and magnetism; with many other things more or less incomprehensible at present, would all be affected by it, and receive a full explanation in their reduction under one general law.

Dr Faraday has made other advances since he penned the foregoing in 1837, and more of the mysterious connexion of *light*, electricity, and magnetism has been laid open by experiment. I could earnestly wish that the pure solar beam were always made the subject of these investigations, for *it is the fountain* of all, and more likely to lead to the discovery of the *truth of nature* than the secondary light emanating from chemical combustion. However, discovery must, perhaps, proceed step by step, and we welcome its progress.

One more quotation must suffice to disclose the position of electric laws, as we find it in the opening paragraphs of the *Researches* of 1838, on the '*Nature* of the *Electric Force or Forces*,' The *electric current* had been viewed throughout as an *axis of power* having contrary force, exactly *equal in amount in contrary directions*, and the author thus embodies the principles of an *hypothesis* derived from experiment: it assumes—

> That all *particles*, whether of insulating or conducting matter, are as wholes *conductors*.
>
> That not being polar in their normal state, they can become so by the influence of neighbouring charged particles, the polar state being developed at the instant, exactly as in an insulated conducting *mass* consisting of many particles.
>
> That the particles, when polarized are in a forced state, and tend to return to their normal or natural condition

That being as wholes conductors, they can readily be charged, either *bodily* or *polarly*.

That particles which, being contiguous, are also in the line of inductive action, can communicate or transfer their polar one to another *more* or *less* readily.

That those doing so less readily require the polar forces to be raised to a higher degree before this transference or communication takes place.

That the *ready* communication of forces between contiguous particles constitutes *conduction*, and the *difficult* communication *insulation;* conductors and insulators being bodies whose particles naturally possess the property of communicating their respective forces easily or with difficulty.

That ordinary induction is the effect resulting from the action of matter charged with exciting or free electricity upon insulating matter, tending to produce in it an equal amount of the contrary.

That it can do this only by polarizing the particles contiguous to it, which perform the same office to the next, and these again to those beyond; and that thus the action is propagated from the excited body to the next conducting mass, and there renders the contrary force evident in consequence of the effect of communication which supervenes in the conducting mass upon the polarization of the particles of that body.

With this statement of a most refined hypothesis, I come at last to the consideration of its applicability to electro-culture. It may so happen that nature is all-sufficient to supply each individual plant with its appropriate share of atmospheric *power*, and if so, our machinery can be made of no real service. Still, as a question of philosophy, it would be equally edifying and delightful to prove that a stimulus in excess was at command; and, with that discovery, we might rest pretty nearly certain of the mode of action in all cases where a series of copper wires was found to act beneficially upon the plants growing in a small plot of ground.

By the propagation of excited particles *throughout that system*, we should act upon decomposable particles around and *beyond* it; for the electric power thus distributed would perform the roll of a voltaic apparatus upon the moistened manure combined with the earth, whether they were *organic* or *inorganic* in their nature.

Let experiment prove, beyond question or doubt, that the atmospheric electricity *may* be communicated to the soil, and then the cultivator can proceed, step by step, in hope, till at length, by the aid of chemical science, and the wise application of mechanical structure, something truly beneficial to agriculture may, in process of time, be ascertained and adopted.

The use of Definite Rules for determining the Merits of Stock at Cattle-Competitions.—1. In the progress of science and art, their principles and rules acquire definiteness in expression, and precision in application; and in both these respects, it is conceived, the system which is ordinarily pursued in deciding upon the merits of stock at competitions, is susceptible of considerable

improvement. In the following paper, means of amelioration are, with much deference, suggested, and some collateral benefits of an improved method of procedure are pointed out. If the suggestions should be deemed worthy of attention, no doubt need be entertained that men, eminent for their scientific and practical attainments, would, in the exercise of their wonted liberality, when any object of interest and utility is sought to be accomplished, readily contribute their assistance towards the organization of the necessary preparatory measures, in which much of the difficulty attendant upon the adoption of the proposed change would probably be experienced.

2. In an article, by Colonel Le Couteur, on the Jersey Cow, published in volume V. of the *Journal of the Royal Agricultural Society of England*,* a plan is described, which has been adopted in that island, for regulating, by definite rules, the decisions of judges at the Cattle Shows of the Jersey Agricultural Society. The rules are embodied in the form of scales of points — one scale for bulls, and another for cows and heifers. A judicious selection appears to have been made of animals possessing high degrees of excellence in dissimilar respects, from which standards of ideal perfection were framed; and, under the practical application of them, great improvement seems to have taken place, both as regards the appearance and the fattening properties of the breed, without detriment to its milking qualities.

3. The immediate object of the plan is to describe, with accuracy and clearness, those points or characteristics which, according to the concurrent opinions of the most experienced and skilful men, denote excellence in stock, and, by assigning to them numerical equivalents symbolizing perfection, to furnish well-adjusted standards, easy to be understood and applied, for determining the merits of competing animals. The process of examination indicated by the scheme, must, indeed, be observed, to a greater or less extent, even in the absence of determinate standards, in all cases in which the decisions pronounced are the results of a wise discrimination, and are capable of being maintained and defended on rational and intelligible grounds.

4. The scales employed in Jersey, for the breed of the island, are as follows:—

Scale for Bulls.—1. Purity of breed on male and female sides reputed for having produced rich and yellow butter, . . . 4 Points.

* And in the Eleventh Annual Report of the *Jersey Agricultural and Horticultural Society* for 1844, pp. 41-2, where it is stated that "the above points were approved of and decided on by Messieurs Brechaut, Bevens, Le Gresley, Simon, and Le Bas, cattle-dealers, in presence of his excellency the president, and the committee, for 1834." Editor.

2. Head fine and tapering, cheek small, muzzle fine and encircled with white, nostril high and open, horns polished, crumpled, not too thick at the base, and tapering, tipped with black; ears small, of an orange colour within; eye full and lively,	8	Points.
3. Neck fine, and lightly placed on the shoulders; chest broad, barrel hooped and deep, well ribbed home to the hips,	3	...
4. Back straight from the withers to the setting of the tail, at right angles to the tail; tail fine, hanging two inches below the hock,	3	...
5. Hide thin and movable, mellow, well covered with soft and fine hair of a good colour,	3	...
6. Fore arm large and powerful, legs short and straight, swelling and full above the knee, and fine below it,	2	...
7. Hind quarters from the huckle to the point of the rump long and well filled up; the legs not to cross behind in walking,	2	...
8. Growth,	1	...
9. General appearance,	2	...
Perfection for bulls,	28	

No prize to be awarded for a bull having less than 20 points.

Scale for Cows and Heifers.—1. Breed on male and female sides reputed for producing rich and yellow butter,	4	...
2. Head small, fine, and tapering; eye full and lively; muzzle fine and encircled with white; horns polished and a little crumpled, tipped with black; ears small, of an orange colour within,	8	...
3. Back straight from the withers to the setting of the tail; chest deep and nearly on a line with the belly,	3	...
4. Hide thin, moveable, but not too loose, well covered with fine and soft hair of good colour,	2	...
5. Barrel hooped and deep, well ribbed home, having but little space between the ribs and hips; tail fine, hanging two inches below the hock,	4	...
6. Fore legs straight and fine; thighs full and long, close together when viewed from behind; hind legs short, and bones rather fine; hoofs small; hind legs not to cross in walking,	2	...
7. Udder full, well up behind; teats large and squarely placed, being wide apart; milk veins large and swelling,	4	...
8. Growth,	1	...
9. General appearance,	2	...
Perfection for cows,	30	...

Two points to be deducted in the case of heifers, as their udders and milk veins cannot be fully developed For a heifer, therefore, 28 points will indicate perfection.

No prize to be awarded for cow or a heifer having less than 21 points.

5. The principle of the system does not appear inapplicable to this country. On the contrary, there seems reason to think that, if the accurate and extensive knowledge of stock, which so largely exists, were made available for the construction of scales, adapted to the various cultivated breeds of animals, the introduction of the scheme would be calculated to produce important advantages; and the following examples are adduced of the benefits which it would be fitted to realise:—

1. To establish well-defined standards of excellence for different breeds and classes of animals.

2. To promote and maintain uniformity in the grounds of judgment in appreciating the merits of animals at competitions.
3. To furnish data from which a tolerably correct opinion might, at any time, be formed of the progress towards perfection of the several breeds in different parts of the country.
4. To supply information useful to breeders of stock.
5. To impart augmented interest to public exhibitions of stock, and to extend correct knowledge of the constituents of excellence in the configuration of animals.

6. The first of those advantages would be inherent in the plan itself; the second would arise, as a necessary consequence, from its application at cattle-shows; the third would accrue from the appreciable indications which the decisions of judges would afford of the measures of advancement attained by the various breeds in different districts; the fourth would proceed as well from the lessons to be derived, in a general sense, from rightly adjusted scales of points, as from the particular intimations to be obtained from the details of actual awards, suggestive of the means for removing excesses and supplying defects in stock; and the fifth would result from exhibiting, along with prize animals, the findings of the judges indicating the marks and degrees of excellence by which the animals might be distinguished in comparison with the assumed standards of perfection, and from the appropriate and ready expedient which would thus be furnished for the diffusion of sound information relative to the manifold elements required to constitute faultless specimens of different descriptions of stock.

7. Standards, displaying superior skill and intelligence in their adjustment, could scarcely be otherwise than highly acceptable to competitors, inasmuch as they would strongly tend to satisfy their minds that whatever estimate might be formed of their stock would be regulated by known and approved criteria, restrictive of exuberance of fancy, and promotive of correct appreciation. Judges, indeed, might not perhaps be disposed, on the first blush, to view them with equal favour. They might possibly regard them as finical and artificial, and even as a somewhat presumptuous attempt to limit their discretion, to increase their labour, and unduly to bring their adjudications within the scope of vulgar criticism. Yet, on reflection, they too, it might be hoped, would rise above all such considerations, and be won to the advocacy of them. As men of understanding and practical knowledge, they could hardly fail, in the supposed case, to be convinced of the justness of the standards, as exhibiting the best established indications of excellence, or to perceive the suitableness of them as respects their adaptation to the important purposes

designed to be accomplished by them; while, as conscientious and public-spirited men, charged with a nice and responsible duty, it might not unreasonably be expected that they would willingly avail themselves of the aid to be derived from them in the discharge of their delicate trust, so as not only to ensure their own approbation, but also to afford satisfaction and instruction to competitors, as well as gratification and benefit to the public.

8. The application of the plan would be comparatively easy in the case of single animals; and, except in the bearing which the standards might be allowed to have on the determination of judges generally, it might, in the first instance, be advisable to restrict the use of them to single animals, or, at most, to small lots.

9. The standards would, of course, be liable to modification, according as the advancement of the physiological and practical knowledge of the domesticated animals might render necessary.

Smut in Grain.—By Mr John Lawson, Elgin.—After Göethe promulgated the doctrine, that all external organs are *metamorphosed leaves*, botanists were enabled to arrive at the conclusion, that a grain of wheat is a single leaf in an altered state. Strange as this doctrine may appear, yet it is astonishing how curiously it coincides with the fact, that when the seeds of grain are affected by smut, a leaf is frequently found growing out of the part which, in a sound grain, forms the pistil of the flower.

The object of this paper is to show, that smut in grain is closely connected with vegetable *morphology*, and to point out the manner in which smut is produced, and how it may be prevented.

The *stamen* of the flower of a plant is very unlike a *leaf*, and yet in double roses, pæonies, tulips, and anemonies, all manner of transitions, from stamens to petals, may be detected. Again, a *seed* of wheat, barley, or oats consists of two parts—an outer or external body, which we call the seed, and an internal body of a smaller, but nearly similar form, and of a green colour, which contains the milky juice of the seed.

Now, these two bodies, which remain separate and distinct from each other (in the earlier stages of their growth) in a sound grain of wheat, barley, or oats, mix or amalgamate together, when the seed assumes the form of a smut-ball; for when in the form of a smut-ball, there is no division of the seed into these two bodies—like one cup, as it were, in the inside of a larger one—but both grow up into one united spongy mass of greenish coloured matter, without producing any milky juice.*

* See Journal of Agriculture for March 1844. A person wishing to know the

It has also been observed by botanists, that "when plants are in a state of *slow growth*, as in hot and dry summers, the *appendages* of the *axes* of the flowers are retarded in their growth, fixed in whorls, and receive a tendency to imperfect development, which will inevitably produce flowers; while, on the contrary, no arrestation of growth, nor any fixing in whorls, or only partially so, will take place when plants are in a state of constant and rapid growth; and, consequently, almost nothing but leaves will be the result. This is illustrated by a fact well known to all observing gardeners, viz., that in wet and warm springs, a great number of the *blossom buds* of pears and apples are converted into *leaf buds*, by the excessively rapid developement which they undergo—breaking up the whorls of their flowers, throwing an excessive quantity of sap into the organs which had been destined for flowering purposes, and thus converting them into leaves." Now, while such is the effect produced on the *flowers* of a plant, by the rapid development of their parts, a cause somewhat similar, acting on the *seed* itself, would make the *outer* and *inner* cups of the seed to amalgamate or grow together, and change the structure into that of a smut-ball, in which no inner cup is to be found, the whole seed being one mass of greenish-coloured vegetable matter.*

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form or appearance of smut in barley or oats, during the first stage of the disease, may get some slight idea of it by examining minutely the head of a common garden cauliflower.

* The change produced in the axes of the whorls of the flower of a wheat plant when it becomes a smut-ball, may be thus illustrated. Suppose the *base* of the fructification commonly called the flower, to be represented by fig. 1, then the calyx rises from the outer circle, the corolla from the next inner circle, the stamens from the next, and the outer and inner cup of the *seed* from the innermost-ones *b c*. Now, as the circle from which the stamens arise frequently produces petals instead of stamens, so from the base from which the seed arises, (in the case of a smut-ball,) we find a roundish body growing up, in which the two cups of which the seed is composed, form one adhering mass of greenish matter, which, in a few days after it is fully grown, changes into a white substance, which again speedily changes into the black fœtid powder of a smut-ball. This process, which alters the seed, affects also, sometimes, the position of the filaments of the stamens, so as to unite them to the sides of the smut-ball, and incorporate them with its substance.

Fig. 1.

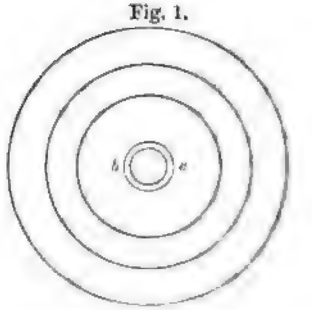
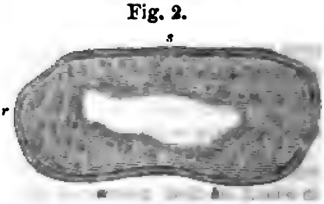


Fig. 2.

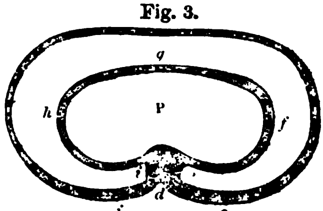


I have endeavoured, in the transverse slices of some specimens of smut-balls, and of real seeds, dried in their green state betwixt plates of mica, to trace, by the microscope, the manner in which the inner cup becomes amalgamated or obliterated in a smut-ball. In these

It is a very general remark, that smut is more prevalent in one season than another, and we can easily see how this takes place, if the alteration in a seed which becomes smut, namely, the amalgamation of the outer and inner cups of the seed into one cohering mass of greenish-coloured matter, arises from an alteration in the *axis* of the *seed*, caused by the stimulus which the plant had received from the quantity of its nourishment, or from the manner or degree in which that nourishment was conveyed to it, at a particular stage of its growth. By examining a wheat-plant, for example, it will be found, that its flowers are affected by this disease, *as soon as they are formed within the plant*; and if the nature or supply of nourishment at the time these flowers are being first formed, is such as would effect a derangement of the parts of the flower, a somewhat similar process, acting on the seed itself, would also have a tendency to effect a change in the structure of those parts of the axis from which the seed arises—causing the two parts of the seed to grow up in one cohering mass of greenish matter, as we find it to be.

Considerable light might perhaps be thrown on this subject by keeping a record of the weather and state of the soil, *at the time* the ears or spikes of plants begin to form *within* the plant, and comparing the prevalence or absence of smut in a field at a later period, or at harvest, with the wet or dry state of the weather *at the time* the ears or spikes began to form within the plant.*

Fig. 3.



specimens I find that the change takes place at that part of the seed which is represented by *a b*, in the smut-ball, fig. 2. In a real seed, fig. 3, a greenish band may easily be traced as pointed out by the line *c d e f g h i j*, the part of which marked *e f g h i*, forms a cup or bladder *P*, into which the milky juice of the seed flows. In a smut-ball again, the outer line or band, goes fairly round the ball or seed. There is no branching off at the part *a b* of the smut-ball, fig. 2, as there is at *i e*, fig. 3. On the contrary, the spongy mass of which the smut-ball is composed, grows *inwards* from the inner surface of the outer cup *r s t*, fig. 2.

In a smutted ear of *barley*, the axis of the fructification is more disarranged than of either a wheat or oat plant, so that not only are the two cups or sacs of the seed of barley amalgamated together, but the *calyx* also is found growing out of the *sides* of the smutted seed. In a sound seed of barley, the calyx rises out of the receptacle, and is found growing at a little distance from each side of the seed; in a smutted seed of barley, again, the calyx is frequently *incorporated with*, and grows out of the sides of the diseased seed. In the one case, the calyx rises from the receptacle, and is quite detached and free from the seed; in the other, it grows out of the smutted seed. In a smutted plant of the two-rowed variety of barley, we may have a striking example of vegetable morphology. The *adhesion* of parts, also, may be finely illustrated, wherein we can trace the calyx amalgamating with, and coming out of the sides of the diseased seed.

* The weather of 1845 was very dry in Morayshire, during the time the *wheat* was forming its ears or spikes *within* the plant, and we heard of little or no smut in wheat in that quarter of the country that season. Again, the weather became very wet at the time many fields of barley and oats were forming their

When a change is effected in a flower, and its stamens converted into petals, we find that the plant thus changed retains its peculiarities, and continues afterwards to produce double flowers. In like manner, the *seed* of a plant of wheat, barley, or oats, being also thus partially changed in structure, may have a tendency impressed on it which will make it completely smutted when again grown, for the axis from which the seed springs, being partly altered in the plant then growing, the seed of that plant, from the special predisposing cause impressed on it by the first change, may produce another plant in which the axis of its flowers will be still more altered; and if the stimulus which this second plant receives when growing, be also of such kind or degree as to increase still further the alteration of the axis of its seed, a more smutted plant may thus arise; while, on the other hand, a properly cultivated soil, by favouring the *regular development* of the different parts of a plant, may counteract the causes which would otherwise have produced smut.

Smut, as has been already stated, appears first in the form of a ball of a pulpy-like substance, and of a greenish colour, composed of vegetable matter like the parenchyma of a plant, and filled with slender threads crossing each other in all directions, the whole soon changing into a black corrupt stinking substance; and from the view now taken we can easily imagine how the various vessels emerging from the *axis*, and which supply nourishment to the seed, and to the pollen of the stamens whose filaments are frequently found incorporated with the side of the smut-ball, being disarranged, and pouring their juices of vari-

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ears within the plant, and in those fields of barley and oats, I found smut extremely abundant. In many fields of rye, under these latter circumstances, I also found much *ergot*, as also a substance in barley, which, in appearance, very much resembled ergot, and to which I referred in this Journal for March 1844.* The ergot of rye and the blackish looking substance of barley, consist, apparently, of a whitish, mealy, farinaceous-like substance, elongated beyond the calyx, and covered with a black skin. In the production of these bodies, the organ or gland of the seed seems to be altered only so much from its normal state, as still to be able to perform its functions in part, though the nature of its products is partly altered in their chemical constituents. Thus, the ergot of rye possesses peculiar properties which render it useful in medicine; and it is probable that the horny substance of barley may also contain altered products, though I am not aware that they have yet been investigated, or that this horny substance had been previously discovered. The difference in its structure, however, from a true seed, and its resemblance, in appearance and form, to ergot, would lead me to conclude that it cannot be the same in its chemical composition as a real seed of barley. When these ears of barley are examined in a green state, a clear fluid, like water, and possessed of a sweet taste, frequently exudes in considerable quantity from the diseased floret.

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* In the Athenæum for September 1845, in an account of a meeting of the Paris Academy of Sciences, held on 18th August of the same year, mention is made of M. Vallot having announced to the Academy, that he had seen ergot in barley, as well as in rye. It is but justice to our correspondent, Mr Lawson, to state, that he took notice of the existence of such a substance in this Journal for M[illegible]4—bein[illegible]enteen months prior to the announcement [illegible]

ous kinds into an unnaturally swelling body, may produce a substance which, from its peculiar nature, may speedily undergo decomposition, and produce the black fœtid powder of smut-balls, considering especially the situation of the ear of grain at the time smut is forming, being then enclosed in the stalk or rolled-up leaf of the plant, and surrounded with air and moisture, and the plant's natural heat.* This disarrangement of the axis of the seed is often so great as to extend its effects to the whole parts of the flower, so that not only the seed, but also the calyx and corolla are affected by it, and filled with the greenish-coloured vegetable matter above referred to, which becomes corrupt and black. And here it is not undeserving of remark, that we only find smut in such plants as have a structure of seed like that we have now described, viz., that which is presented by corn, grasses, and such like, whose seeds all consist of one cup growing within another, the inner cup, in its normal state, containing the milky juice. This remark I conceive to be of importance, because if smut arises from the disarrangement of the axis of the seed, causing its two cups to grow a mass of greenish matter, as we actually find it to be, then no other plants than those of this structure can produce smut, and this we also find to be the case.

There are various ways in which the supply of nourishment may be afforded, either in quantity or quality, so as to alter the axis of the seed, and produce smut. The cloddy nature of an ill-tilled soil has its own peculiar effects, and the roots of plants may produce similar results, according to their development in a badly cultivated soil. Referring to practice, we find, in accordance with this remark, that an ill-tilled soil has generally more smutted plants than a properly tilled one. Much rain also, at a particular stage of the growth of a plant, as already stated, and likewise some kinds of manure, may produce, or assist in producing the same effect, for we know that alkalies, silica, and sulphates act on the straw, whilst phosphates increase the quality and weight of grain; and of late years we have seen an effect produced on the vegetative properties of seed, by steeping it in a solution of mineral substances, previous to its being deposited in the soil. And what is it we do to prevent smut? Why, we apply an inorganic solution to the seed before sowing it. Thus, we pickle seed with common salt, with salts of copper, &c. May not the effect of these applications be, while they stimulate the growth of particular organs, to check the growth

* It is found, by chemical analysis, that smut contains a considerable portion of nitrogen; and Professor Liebig informs us, "that there is in the nature of nitrogen some peculiarity which gives its compounds the power to decompose spontaneously, with so much facility."

of others, and thus fix the axis of the seed, and prevent its forming in such a way, as to produce a swelled mass of greenish coloured matter, and of course smut?

I have frequently observed oat and barley plants growing up in light soils, in a moist and warm autumn, *after* the crops have been cut down. These plants of second growth have a remarkably *rapid growth*, rising from the root, and producing flowers within two or three weeks, and in such plants smutted heads are extremely numerous.

From these statements, then, it would appear that smut has a close connexion with vegetable *morphology*.

The moist state of the atmosphere at the time the ears or spikes of grain are first being formed *within* the plant, may be aided, or prevented producing smut, by the state or nature of the soil as regards its tillage, its wet or dry state, or its mineral contents; and in practice we find, as already stated, that a properly cultivated field is less subject to smut than a soil improperly tilled, because the former favours the proper and regular development of all the parts of a plant. Hence, such a soil may not only be the means of preventing smut altogether, but may also diminish its amount, where other causes tending to produce it are in existence.

The substance of these remarks is—First, that as the different parts of the flowers of a plant are changed into one another by an alteration in the *axis* of the flowers, by particular exciting causes, so also the *seed* itself may likewise, in corn and grasses, be affected and changed by an alteration of its axis, so as to make the two parts of which the seed is composed, grow up into one united greenish-coloured spongy mass, whereby the natural functions of the different parts of the flowers and seed are destroyed, and produce that mass which ultimately becomes of a black or brown colour, and is called smut.—Second, that that mode of cultivating the soil, and those applications which produce a regular development of the parts of a plant, are the best preventatives of this destructive malady.

*Burn Murdoch's Notes and Remarks made in Jersey, France, &c.**—Having ourselves derived pleasure and profit from the perusal of this unpretending work, we are desirous to draw the attention of our readers to it, and permit them to share in our gratification as far as a few extracts may enable them to do so. Like most of our Scottish country-gentlemen, the author is well

* Notes and Remarks made in Jersey, France, Italy, and the Mediterranean, in 1843 and 1844. By J. Burn Murdoch, Esq. William Blackwood and Sons, 1846.

acquainted with the practical details of farming and rural economy in general; and he occasionally furnishes us with matter which falls directly within the scope of our Journal. The author disclaims the idea of writing a book of travels. His object is merely to record certain observations, believed worthy of attention, which a recent visit to the Continent afforded him the opportunity of making. His constant practice was to mix with the people of the different countries through which he passed—to travel by public modes of conveyance in preference to private ones—and to manage in every instance for himself, what many travellers devolve on the agency of others. He thus obtained opportunities of studying character, and familiarising himself with national habits and modes of managing business, of which many English gentlemen, by travelling too much in state, completely deprive themselves.

Mr Murdoch's is one of the few works of modern travel, that we should like to have seen more bulky and comprehensive. He has been too anxious to avoid touching on subjects which have been handled by others. He says—

As I shall avoid copying from the writings of others who have preceded me, I shall be prevented, in many cases, from noticing the most important features and events connected with the places through which I passed. The reader will, therefore, neither find in my volume a chapter on the Louvre, and its works of art, nor upon the other wonders and attractions of the capital of France, just because I do not choose to reprint Galignani's Paris Guide; and neither may he consult my book for an account of the sieges, and captures, and surrenders, of the fortresses of Malta and Gibraltar.

It is easy to carry this feeling too far. It is very true that the history of such places, in all its extent and importance, ought to be sought for in works expressly devoted to the subject; but these are not always at hand, and even if they were, we may not be disposed to consult them. In lending our attention to such important localities, is it not an advantage to be occasionally reminded of a date, or an important incident, even though, by so doing, we cease to be original? It is a great convenience to a general reader, even though he may once have known the facts, or could ascertain them by application to the proper quarter. An occasional reference, also, to eventful occurrences, of which any given locality may have been the scene, enables us more readily to realise its historical associations, while it forms a kind of central point around which our own observations may gravitate—a kind of osteology, giving consistency and support to what otherwise would be feeble and unconnected. Our author seems to think that it is impossible to write in an original and profitable manner on subjects which have been so often written on as the great works of nature and art that attract the eye of the European traveller. It would be a pity if any such notion were to

prevent any competent person from writing a journal, or even, if he thought proper, of laying it before the public. Although the objects to be seen may be in their own nature nearly invariable, yet they are continually presenting new aspects and relations, according to the medium through which they are viewed. The mental qualities of the individual observer constitute that medium, and it will vary according to original constitution, educational acquirements, and professional bias. No one of good sense, powers of observation, and general intelligence—such as the present author—need hesitate, therefore, to record his own observations on the interesting objects that fall under his eye, merely because they may have exercised a multitude of other pens. If he write from his own mind he will be original, and in all likelihood instructive, and his remarks will commend themselves more especially to those whose natural and acquired qualities of mind resemble his own.

Our author gives some account of the state of agriculture in the island of Jersey, where he resided for some time.

The climate of Jersey is very mild, and damp, and soft, peculiarly favourable to vegetation. Indeed, the pasture-grasses never ceased growing the whole season, and milch-cows were constantly out in the fields. I visited the dairy of Mr G—— upon the 8th March; his cows were all in the field, and the grass very rich, reaching halfway up to their knees. This gentleman may be taken as a good specimen of one of the best of the native Jersey proprietors and farmers. His farm, facing the south, upon St Aubin's Bay, consists of about fifty acres; of these, eight acres only are under the plough, the rest being orchard and meadow. The grain grown is all consumed by the family, the butter and cider constituting the marketable portion of the produce; 420 hogsheads of cider were made on the farm in 1843, which was not reckoned a good apple season. . . . Mr G——'s stock of cows were, as a whole, the finest specimens of the breed I had seen. I had much conversation with him on the subject of the dairy stock of the island; and he agreed with me in thinking, that the Jersey farmers are breeding too much in and in, and too much sacrificing size and bone to artificial points of excellence and beauty, which they judge as evidences of purity of breed. I was the more convinced of the truth of this, after witnessing the show of bulls which took place in April following. The animals exhibited were really very pretty; their beauty, however, was more that of the deer than of the bull; and it may probably excite a smile in my reader to be informed, that the prize-bulls, gaudily decorated with ribbons, (the evidences of their success in the competition,) were generally led home by women, more like pet sheep than any thing else. The regulations as to rings in the bulls' noses, enforced in Britain upon such occasions, are unnecessary and unknown in Jersey. Mr G—— mentioned to me his intention of attending the English agricultural show at Southampton in August following, and purchasing a Devon bull. I advised him strongly against that plan; the difference between the Devon and Jersey breed being too great. My advice to him was to send to Scotland, and get one of the purest Ayrshires he could obtain. The Jersey and Ayrshire are breeds both cultivated for their milk; they have very many points of resemblance in common; and the superior size and bone of the Ayrshire breed would renovate and strengthen that of Jersey, without materially changing the type and shape of the animal.—p. 83.

The soil in Jersey is remarkably fine; deep, and dry, and friable. In order to obtain sufficient depth of soft soil for the roots of some of the plants they cultivate, the farmers have frequently recourse to trench-ploughing, and do not hesitate to bury from time to time the whole upper or previously cultivated portion of the soil, and bringing up an entirely new portion. This operation is performed by the great plough.

This implement, on one occasion when our author saw it in action,

Was drawn by eight horses, preceded by a small plough with two horses. The small plough cut off a slice from the surface, of about ten inches broad, and four deep, which fell into the bottom of the furrow which had been *previously* made; the large plough then came up, taking with it the same breadth of furrow, but going down to a further depth of ten inches, which slice was laid over upon the top of the last or surface slice; thus completely burying it, and altogether ploughing to a depth of fourteen inches. The eight horses were yoked two and two, and appeared to be working up to their full strength when making the furrow. The plough was very clumsy, and not very well harnessed, so that much force was unnecessarily wasted in the operation. It is evident, if the whole horses were somewhat distressed in making the furrow in the centre of the field, that when they came to the turn, the whole stress falling upon the horses next the plough, they would be unequal to the task. Such was the case; and, in order to remedy the defect, at the end of the furrow was a spadesman, who made a ditch or trench of several yards long in the same line, so that the plough had then no soil to turn over, and the last horses had only to carry the plough round. The top of the opposite furrow was prepared in a similar manner, by which means the full stress was not put upon the plough till the whole eight horses were in line, and able thus to exert themselves in company. Notwithstanding all this, the horses seemed to struggle very much, both in taking the turn and in again commencing the opposite furrow. They were otherwise well trained to the work, and took the turns at the word of the driver. The land is ploughed in breaks or patches—the horses always going round from one side of the break, whatever may be its breadth, to the other, so that there are no ridges visible; and, when finished, it resembles one of our well-drained fields which are ploughed without ridges, by means of the shifting mould-board plough. On this occasion, there were *ten* horses, *eight* men, *one boy*, and two women employed; and the farmer informed me that they could do nearly two statute acres a-day. The ploughmen give themselves very little trouble as to making a straight furrow; providing the land is all stirred and deepened, they care for nothing more. There are spadesmen constantly employed smoothing and straightening the surface after the plough; indeed, the last made furrow exhibits a line very graceful from its curves, reaching at some parts its proper extremity, and at others a yard within it. The spadesmen remedy this defect, and dig up the parts that have escaped the plough; and, after the whole has been smoothed and straightened, it makes altogether a very tolerable-looking job. —p. 38.

The value of sea-weed as a manure is well known in Jersey, and the mode in which they set about the collecting of it is rather peculiar. The vraic (*varec*, sea-weed) harvest, which is the gathering of the sea-weed surrounding the coasts,

Is regulated by the states, *i. e.* they issue permission to begin cutting upon

a certain day, and fix a time at which it is to cease. Friday, the 1st of March, was this year (1844) the day of its commencement, and early that forenoon, I repaired to the point of Le Hocq to witness the operation. The rocks at this point extend a very great way from the shore at low water, and are covered with the sea-weed. Upon this occasion, the tide was very far out, and little appearance of bustle was observable from the shore, the dark nature of the rock preventing the people being seen from such a distance. Of course, they commence operations when the tide is furthest out, and retreat as it rises. I walked out to the furthest extremity of the dry portion, and there the multitudes of men, and women, and children, and horses and carts, which covered the rocks, quite astonished me. The weed is cut from the rocks by short hooks, and laid in small heaps, and then loaded upon the carts and driven off, till it is carried beyond high-water mark, where it is generally emptied and left, to be carried inland at leisure. It is a very wet job, but still the country people like it—it brings them together; and many courtships are said to be carried on at vraic harvest. They bake bread of a particular kind for the occasion, and their food is otherwise of a more generous description than what is in general use; it is, in fact, a kind of gathering or meeting of the whole people, and, as such, causes a variety and stir in the ordinary routine of the Jersey life. The sea-weed is chiefly used as a manure for grass and garden crops.—p. 45.

The following is the author's account of the market at Vire:—

It being the weekly market-day, I got up, as usual, early, to inspect the several markets. There was a very large assemblage of good-looking and well-dressed farmers and peasants. There were a great many cows, a number of long waggon-shaped carts, filled with lime, in an unoccupied space of ground before the inn; but the curiosity of the morning was the pig-market. The quantity of pigs and swine was immense, such as I never saw congregated before in any other place. The pigs were brought to market in carts. These carts being unyoked, and ranged in a double line, formed a street, down which the purchasers paraded, and inspected the various lots at their pleasure. There were upwards of 100 cart-loads of pigs, each containing a litter of about seven or eight; and when I mention that the purchaser, as he or she made their rounds, stopped at each cart, and had each individual pig examined, by catching it by the hinder leg, and suspending it in the air by the foot while it was handled, the noise made by the junior squeakers is not to be described. I saw one man who had several whole families examined, one after another; and as long as I watched his progress, he made no purchase; although the noise he made that morning, or, at least, caused to be made, in the world, might have gratified the largest ambition.

The poultry and egg market is in the centre of the town, and was very largely supplied: there were above 600 Normandy women selling poultry, eggs, and butter, all wearing the monstrous high head-dress of the district, and they formed a very singular group. The prices of all these commodities were moderate.

The farmers and country people who crowded the streets were of respectable appearance, and decidedly better to live in the world than their neighbours to the west. The horses were good, many of the farmers riding into town on very smart roadsters, while the carts and produce were under the charge of their servants. The carts and harness were most substantial, and well kept; the weight of some parts of the harness is, however, quite preposterous. At a saddler's shop, there was a collar exhibited for sale, the weight of which, with its huge edges and flaps, was between two or three stones.—p. 107.

It is easy to discern, from the signs of the times, that one of the subjects which will soon engage the attention of the public

mind in this country, and be subjected to a keen discussion, is the law of entail. The results arising from the operation of that law, in Scotland especially, are becoming most momentous, and if allowed to go unchecked, may lead many, even of the more moderate and judicious of our countrymen, to desire some sweeping and fundamental change in the distribution of landed property. France and Scotland presents us with instances of the two opposite extremes in regard to this matter, the too great subdivision of property on the one hand, and its excessive accumulation, in the hands of a few individuals, on the other. In a monarchical government, such as is best suited to the genius of the British people, the necessity of some provision for keeping up a powerful aristocracy, as an intermediate influence between the crown and the general population, appears most obvious; but for the maintenance of such a class, there is no need that they should monopolise the soil of the country; and their existence, with all necessary power and influence, is quite compatible with a material relaxation of the existing laws respecting the conveyance of landed property. Mr Murdoch's observations on this subject appear to us to be very judicious, but we have not space to quote them.

Having long taken a deep interest in the veterinary college at Edinburgh, as chairman of the committee of members appointed by the Directors of the Highland and Agricultural Society of Scotland to superintend and regulate its affairs, Mr Murdoch was naturally desirous to ascertain how such establishments are conducted on the Continent. With this view he visited the veterinary college at Alfort, a few miles distant from Paris, and was shocked to find that it was the practice there to dissect living horses.

Upon entering into what appeared to be a place of dissection, I found myself surrounded, not by dead, but by living subjects. It was a building or shed, open to the air on one side, furnished with many strong pillars rising from the floor to the roof. Here lay six or seven living horses, fixed by every possible mechanical device by the head and feet to these pillars, to prevent their struggling, and upon each horse were six or seven men engaged in performing the different surgical operations. The sight was truly horrible. The operations had begun early in the forenoon; it was nearly three o'clock in the afternoon when we entered the place; so the poor wretches, as may be supposed, had ceased being able to make any very violent struggles, but the deep heaving of the still panting chest, and horrid look of the eyes, when such were as yet remaining in the head, while the head itself was firmly fixed to a pillar, was harrowing beyond endurance. The students had begun their days' work on the least vital parts of the animal; the trunks of the animals were there, having lost tails, ears, hoofs, &c.; and they were now engaged in performing the more important operations, such as tying the main arteries, and boring holes in the head, and cutting in upon all the most sensitive and tender places, on purpose, as we were informed, upon our expressing horror at the sight, that they might see the retraction and motion of the several nerves and muscles. One animal had one side of the head, including eye and ear, com-

pletely dissected, and the students were engaged, when we entered, in laying open and cauterizing the ankle of the same animal. What I have described was the result of the observation of a few seconds. I grew absolutely sick, and hastened away from this abode of horrid cruelty.—p. 166.

French operators often show such a wanton disregard of animal suffering as is here noticed. Some of their itinerant lecturers have sometimes disgusted a British audience with similar exhibitions. We remember one in particular, who used to operate on a living dog, in illustration of his prelections, and even to introduce the animal, partially dissected, on several successive occasions. Our abhorrence, however, of such revolting cruelty, is apt, perhaps, to lead us too far in an opposite direction. We may admit, with our author, and the other authorities to whom he refers, that the dissection of living animals is unnecessary, but we cannot help thinking that it may at times be highly expedient. It seems reasonable to suppose, that the knowledge acquired by the examination of an animal as nearly as possible in the same condition as that on which we are to operate for the purpose of effecting a cure, will be much more accurate than that obtained by the examination of an animal in a totally different condition. Now, it is the living animal we attempt to cure by our operations; and if we begin to practice the knowledge we acquired under one set of circumstances, under circumstances so entirely different as those presented by a living animal and a dead one, do we not forego some of the most probable means of success? Many operations, moreover, cannot be performed at all on a dead subject, because they have to do with the actual phenomena of life and feeling. The very desire, therefore, to diminish suffering, may lead us to place a living subject under the scalpel; because that may be the only way of obtaining the means of preventing or diminishing the amount of suffering in multitudes of other animals. The balance, on the score of humanity, may be in favour of such a proceeding; but it would obviously be justifiable only on rare and urgent occasions, and even then on the sole condition that every thing practicable should be done to prevent an unnecessary amount of suffering. The wholesale and habitual manner in which these living dissections are conducted in the veterinary school of Alfort, is disgusting and atrocious, and is alike disgraceful to the individuals who practise, and to the nation that tolerates it.

It is a pity that Mr Murdoch's interesting book has not been more carefully brought through the press. The errors in composition are numerous—words are occasionally used in an improper sense—such as channel for gravel, page 175; and we notice other inaccuracies which are unseemly, and which the least care would have avoided. These, we feel assured, will be corrected in a second edition, should such be required; and, in that event, we feel

confident that we express the opinion of the majority of his readers when we say, that if his portfolio afford the materials, we should be well pleased to see the present volume doubled in size.

*Youatt on the Dog.**—This is one of the publications issued under the long familiar name of the Society for the Diffusion of Useful Knowledge, some time before that association became extinct. It fully upholds the high character which so many of the works sanctioned by that society have held, and which so well entitle it to the gratitude of the public. So much has recently been written on the history of the dog, that little that is new can now be advanced on the subject, and a considerable time may be permitted to elapse before materials for a new work can accumulate. Mr Youatt has here given us all that is essential in the natural history, properly so called, of this animal, and describes all the principal varieties, illustrating the subject with very beautifully engraved figures. He then enters upon the qualities of the dog, its senses, intelligence, &c.; and this is succeeded by a description of the skeleton, the anatomy of the various parts, the diseases, and best mode of treatment. On the two last-mentioned departments he dwells at considerable length; and his extensive experience, and well-known skill as a veterinarian, give great weight to his opinions as to the causes of disease and the curative treatment. The work, therefore, is very comprehensive and complete, and we could not name another which so satisfactorily combines all that is most important for the keeper of dogs to be acquainted with; while a plentiful sprinkling of anecdotes and canine adventures affords attraction to the reader who seeks matter merely for amusement.

It is well known what cruelties the dog has been subjected to in this country by being used as a beast of draught; yet our author does not object to it being so employed under certain restrictions.

He is so in the Northern regions, and he is as happy as any other animal in those cold and inhospitable regions. He is so in Holland, and he is as comfortable there as any other beast that wears the collar. He is not so in Newfoundland; there he is shamefully treated. It is to the abuse of the thing—the poor and half-starved condition of the animal, the scandalous weight he is made to draw, and the infamous usage to which he is exposed—that we object. We would put him precisely on the same footing with the horse; and then we should be able, perhaps, to afford him not all the protection we could wish, but nearly as much as we have obtained for the horse. We would have every cart licensed, not for the sake of adding to the revenue,

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* The Dog, by William Youatt. London: Charles Knight & Co. 1845. (Under the superintendence of the Society for the Diffusion of Useful Knowledge.)

but of getting at the owner; and, therefore, the taxing need not be any great sum. We would have the cart licensed for the carrying of goods only, or a separate license taken out, if it carried or drew a human being.

It is here that the cruelty principally exists. Before the dog-carts were put down in the metropolis, we then saw a man and a woman in one of these carts, drawn by a single dog, and going at full trot. Every passenger execrated them, and the trot was increased to a gallop, in order the more speedily to escape from the just reproaches that proceeded from every mouth. We would have the name and address of the owner, and the number of the cart, painted on some conspicuous part of the vehicle, and in letters and figures as large as on the common carts. Every passenger, who witnessed any flagrant act of cruelty, would then be enabled to take the number of the cart, and summon the owner; and the police would have the same power of interference that they have with regard to other vehicles.—p. 112.

It is to be feared that the toleration of this practice has a tendency to lead more or less to the abuse of it, almost from the very nature of the thing. Such burdens as are thought to require a wheeled conveyance at all, are likely, for the most part, to exceed the strength of a single dog; and it is very improbable that any one in this country would keep several for the purpose of draught, as the end would be much more conveniently and economically served by a pony or an ass. The total suppression of the practice throughout the country is therefore likely to occasion little inconvenience; and it would certainly remove a great incentive to mal-treatment—a mal-treatment the more to be deprecated, because it consists of over-exertion, which must tend to predispose the animal to rabies.

The practice of cropping is strongly condemned by our author:

It is an infliction of too much torture for the gratification of a nonsensical fancy; and, after all, in the opinion of many, and of those, too, who are fondest of dogs, the animal looks far better in his natural state than when we have exercised all our cruel art upon him. Besides, the effects of this absurd amputation do not cease with the healing of the ear. The intense inflammation that we set up materially injures the internal structure of this organ. Deafness is occasionally produced by it in some dogs, and constantly in others. The frequent deafness of the pug is solely attributable to the outrageous as well as absurd rounding of his ears. The almost invariable deafness of the wire-haired terrier is to be traced to this cause.—p. 112.

Then *the tail* of the dog does not suit the fancy of the owner. It must be shortened in some of these animals, and taken off altogether in others. If the sharp, strong scissor, with a ligature, were used, the operation, although still indefensible, would not be a cruel one, for the tail may be removed almost in a moment, and the wound soon heals; but for the beastly gnawing off of the part, and the drawing out of the tendons and nerves, these are the acts of a cannibal; and he who orders or perpetrates a barbarity so nearly approaching to cannibalism, deserves to be scouted from all society.—p. 112.

Our author enters at great length into the subject of rabies, one of the most important and mysterious connected with the history of animals:

In other cases, he says, the comfort and the existence of our quadruped

patients are alone or chiefly involved, but here the lives of their employers, and our own, too, are at stake, and may be easily, and too often are, compromised. Here, also, however other portions of the chain may be overlooked or denied, we have the link which most of all connects the veterinary surgeon with the practitioner of human medicine; or, rather, here is the circumscribed but valued spot where the veterinary surgeon has the vantage ground.

The cases he mentions throw a good deal of light upon the symptoms and endlessly varied modes in which this affection manifests itself. It is of great importance to be able to determine when a dog is affected with rabies. The following observations will assist us in forming an opinion:—The earliest symptoms are occasionally very obscure. In the greater number of cases, there are sullenness, fidgetiness, and continued shifting of posture. In the small French poodle, more especially, which is naturally a restless creature, the two last-mentioned symptoms are very remarkable. A peculiar kind of delirium is another early symptom, and one which, according to our author, will never deceive. He illustrates this by the following anecdote:—

A young man had been bitten by one of his dogs. I was requested to meet a medical gentleman on the subject; I was a little behind my time. As I entered the room I found the dog eagerly devouring a piece of sopped bread. "There is no madness here," said the gentleman. He had scarcely spoken, when in a moment the dog quitted the sop, and, with a furious barking, sprung against the wall, as if he would seize some imaginary object that he fancied was there. "Did you see that?" was my reply. "What do you think of it?"—"I see nothing in it," was his retort; "the dog heard some noise on the other side of the wall." At my serious urging, however, he consented to excise the part. I procured a poor worthless cur, and got him bitten by this dog, and carried the disease from this dog to the third victim. They all became rabid one after the other, and then my experiment ended. The serious matter under consideration perhaps justified me in going so far as I did.—p. 131.

In the early stage of rabies, the attachment of the dog towards his owner seems to be rapidly increased, and the expression of that feeling. He is continually desirous of licking the hands or face, or any part he can get at. A healthy dog should never be permitted to indulge this disgusting habit. In one affected with rabies, the virus can scarcely fail to be deposited in any abraded or wounded surface; and, in that case, there is just as much danger as if the animal had inflicted a wound with his teeth. The author mentions a case of a lady losing her life, by suffering her dog to lick a pimple on her chin. A depraved appetite is another frequent symptom of rabies. The dog either refuses his usual food, or, if he taste it, he often turns away with apparent disgust; at other times he seizes it with avidity and then drops it. This he often does from being unable to complete the mastication of it, owing to the organs of mastication being affected with palsy; and, when this is the case, it may be considered a certain sign of the

existence of rabies. Some very important conclusions may be drawn from the appearance and character of the urine:

The dog, and at particular times when he is more than usually salacious, may, and does diligently search the urining places. He may even at those periods be seen to lick the spot which another has just wetted; but if a peculiar eagerness accompanies this strange employment—if, in the parlour, which is rarely disgraced by this evacuation, every corner is perseveringly examined, and licked with unwearied and unceasing industry, the dog cannot be too carefully watched. There is great danger about him. He may, without any other symptom, be pronounced to be decidedly rabid. I never knew a single mistake about this.

Such are a few of the symptoms of this fearful and mysterious disorder, which the author has investigated with much care. The cause of it is the saliva of a rabid animal received into a wound, or on an abraded surface. In horses, cattle, sheep, swine, and the human being, it is caused by inoculation alone; but, according to some persons, it is produced spontaneously in other animals. The wound, in general, in which the virus has been deposited, heals up kindly, and weeks, even months, may elapse before any irritability or inflammation is felt. The average time in the dog between the bite and the manifestation of the disease, is from five to six weeks; and its duration is different in different animals. In man, it has been known to run its course in twenty-four hours, and rarely exceeds seventy-two; in the horse, from three to four days; in the sheep and ox, from five to seven; and, in the dog, from four to six.

We know so little as to the nature of the rabid virus, that little can be done to counteract its effects. It is not communicated even by actual contact, if the skin be sound; it must come in contact with some tissue or nervous fibre, and, while the absorbents remove every thing else of an injurious nature, it is left unchanged. Neither does it enter into the circulation. Excision of the part is the mode of prevention commonly resorted to, and caustic is commonly applied after the knife has been used. It is a pity that the virus has not yet been analysed. It is reported that Professor Sewell intends this autumn to institute an inquiry into the most successful means of counteracting the virus [illegible] animals, and obviating the fearful [illegible]

The English [illegible]

[illegible] is to dir[illegible]

[illegible]

therefore, is quite of an elementary character; but the author presupposes a rapid advancement on the part of his pupil, for he is soon introduced to subjects, which, we apprehend, he will find somewhat difficult of digestion. Although the work commences with an illustrated alphabet, words of two letters, and other matters adapted to the veriest juvenile in literature, we soon find ourselves involved in very elaborate dialogues on various branches of science, agricultural chemistry, &c., the whole ending with chronology, arithmetic, and black letter.

We are apprehensive that the idea according to which the work is framed, is not a very judicious one. That idea, as we have intimated, seems to be, that it is expedient to associate the objects with which the agriculturist is afterwards to be conversant with the earliest elements of knowledge, and to make them the chief emblems by which instruction is to be conveyed to him. Now there is little, or no more, reason why this should be done with regard to rural matters, than in relation to any other department of knowledge. The idea has never occurred to any one, that the best and most speedy way of making a skilful sailor, would be to teach him from a nautical spelling-book, in which the power of the letter A should be exemplified by an anchor, and his first lesson in words of one syllable formed of such sentences as "Jack drinks grog." So of other professions and occupations. The best way is to impart, in the first instance, a general notion of language, as the medium of communicating thought; and, at a subsequent period, give such a direction to the mind as shall enable it to acquire that knowledge which is requisite for particular occupations and pursuits.

The work is very carefully and neatly got up, well printed, and illustrated with very excellent wood-engravings of many of our domesticated animals, forming, in this respect, a contrast with the works commonly put in the hands of children. It contains a great deal of useful information, and may be perused with advantage by far advanced pupils; but it will never, we suspect, come into use in schools as a rudiment for teaching the English language.

...Keeper's Manual.*—This little work embodies the ... practical apiarian, who has long devoted his at- ... honey-bee, with a view of determining the best ...nt. That his labours have been highly ac- ...s proved by the sale of two large impres-

* ...al; or Practical Hints on the Management and ...he Honey-Bee. By Henry Taylor. Third Edi- ...e and Sons.

sions of his book; the present edition is improved and enlarged, and contains the results of a more matured experience. It is neatly and distinctly written; and the instructions, aided as they are by numerous engraved illustrations, are so easily understood, that no one will have any difficulty in carrying them into practice. The natural history of the hive-bee is given in a comprehensive manner, and all the details of management are concisely and distinctly described. We cannot attempt an analysis of a work of this nature, but can safely recommend it to those who require a guide in this interesting department of rural economy. As a specimen of its contents, we shall give a short extract from the concluding part of it.

As a sting may, perhaps, at one time or other be received, I will subjoin Mr Payne's remedy in his own words—one which I have tried with complete success:—"I pull out the sting as soon as possible, and take a piece of iron and heat it, or, for want of that, a live coal, (if of wood the better, because it lasts longer,) and hold it as near to the place as I can possibly endure it for five minutes. If from this application a sensation of heat should be occasioned, a little oil of turpentine or Goulard cerate must be applied.

But another certain and more simple remedy consists of the immediate application of *liquor potassæ* to the spot, to neutralise the acid of the sting. It should be used in small quantity, on the point of a needle or fine-nibbed pen, introduced into the wound. In the absence of this, *pure liquid ammonia* is said, on good authority, to succeed, if properly applied. Keep it in a close-stopped, small-necked bottle, which should be turned bottom upwards, and held very tight over the part. But any remedy to be effectual must be speedily resorted to; and particularly in the summer, for then the poison is much more active than in cold weather.—p. 135.

When proper care has been taken of them, I have seldom known a person who willingly discontinued the keeping of bees; but failure is often occasioned by wilful neglect, and an adherence to vulgar prejudice; or, perhaps, it is attributable to bad situation, or an unfavourable honey locality. The latter has much to do with the system proper to be adopted, and especially as regards large collateral hives, which are far from suitable to every neighbourhood. Particular seasons also have great influence, and the treatment of bees must vary with them, as a little experience (aided by a journal of proceedings) will demonstrate; for the same experiment tried in different years and situations will frequently produce opposite results.

Respecting the durability of a colony of bees, I am inclined to think, that in no other way is it so likely to be certain as in well managed depriving hives. I am not speaking of the bees themselves, for they are undoubtedly reproduced annually. There seems no reason to doubt that, barring casualties, the decay of the dwelling is the only limit to the duration of a bee settlement. Gelieu had them for twenty-five years, though in his time the combs had been renewed, by periodically cutting out the oldest of them in succession, the vacancies thus made being soon supplied by the bees. Some have assigned a period of six or seven years, as that in which all the combs should be thus removed, but I think this is too long. It should be done sparingly at a time, and early in the spring. After a while, there is no doubt the old combs are contracted by use, become black, filled with an accumulation of brood-bread, and are less favourable to the intended design than at first. After all, the use of certain hives, or boxes, obviates the difficulty; such, for instance, as Dr Bevan's bar hives; or still better, [illegible] White's boxes. But I have seen a stock in perfect health

of fifteen years' standing, where, as I was informed, little or no pruning of the combs had been resorted to. It had never swarmed, and the weight of the honey taken from it was stated to have frequently been forty-five pounds. This is less than may sometimes be calculated on in a good bee district; for a collateral hive, well managed, from which I once knew ninety pounds taken in a favourable season, leaving abundance of winter store.—p. 139.

*Lindley's School Botany.**—In the wide and interesting field of botanical science, few have laboured more zealously and successfully than Professor Lindley. The various works he has published, taken together, form a complete course of botanical instruction, replete with valuable information, and almost unrivalled for the profusion, extreme accuracy, and occasional beauty of the illustrations. These are chiefly executed by Mr Palmer's glyphographic process, and possess almost the clearness of engravings on copper or steel, with the depth and broadness of effect observed in the best wood-engraving. Some of the illustrations in the third edition of Mr Lindley's large and most elaborate work, entitled the Vegetable Kingdom, we prefer to any thing of the same kind that we have had an opportunity of examining. The representations of the minute parts of the flowers and fructification, on which the position of the plant in the classification depends, are very accurate and satisfactory.

The School Botany is a work of an elementary character, and was originally prepared for the use of the students in the University of London. The principal natural orders are described at some length, their characteristic features pointed out, and each of these illustrated by an engraved example of some plant indigenous to Britain. The first chapter treats of plants in general, and describes their various parts, the roots, structure and form of the leaves, inflorescence, fructification, &c. The classes of plants are next explained, and in this department De Candolle's system is followed.

The work is strictly botanical; that is to say, it is confined to an exposition of the parts and structure of plants, their systematic classification, and such like subjects. The economical uses, geographical distribution, and other interesting aspects in which plants present themselves to our notice, are scarcely ever alluded to. The work, therefore, is peculiarly dry and technical, and

* School Botany; or the Rudiments of Botanical Science; by John Lindley, P.H.D.F.R.S., Professor of Botany in University College, London. New Edition. London: 1845.

The Vegetable Kingdom; or the Structure, Classification, and Uses of Plants, illustrated upon the Natural System. By Professor Lindley. London: 1846.

need not be opened by the general reader: it is exclusively intended for the determined student of botany.

Such, likewise, may be said to be the case with the handsome volume above alluded to, the Vegetable Kingdom. It is a perfect store-house of minute details, elaborate descriptions of the parts of plants, their botanical characters, &c., but these are carried such a length, that they leave but small space for matters of general history. We should say, therefore, that it is a work for occasional consultation, rather than one to be resorted to for interesting information of a general kind relating to the vegetable world.

Mr Lindley is devoted to the natural system, and seems to imagine that the artificial, or Linnean method of classification, is now altogether abandoned. We should hope, for the interests of botany, that this is far from being the case. We feel confident that the beauty and simplicity of the Linnean method have been the means of attracting many young minds to the study of natural history, who would otherwise never have felt an interest in it. It so readily and easily leads them to important results, that they can scarcely fail to have a desire to advance on a path which it is so pleasant to tread. It is a mistake, moreover, to regard it as altogether an artificial system. It is so, doubtless, in principle, but in the application, it is often strictly natural. But its simplicity must ever be its high recommendation. Having once mastered a brief introduction to the Linnean system, the student is perfectly competent to enter upon a *systema plantarum.* Let him, under similar circumstances, have recourse to Mr Lindley's Vegetable Kingdom, he will feel like one bewildered, not knowing which way to turn. Nay, even the School-botany, elementary as it is intended to be, will be found sufficiently perplexing, and convey him but a very short way in obtaining a knowledge of the method of discovering the names and uses of the plants he happens to fall in with. The natural system, in our opinion, should never be studied, till a considerable acquaintance with plants has been acquired by the artificial method; it can then be entered upon with advantage, and with the prospect of giving that completeness and philosophical elevation to our botanical knowledge which it alone, we admit, is competent to bestow.

*Artificial Preparation of Turf.**—All the materials employed as fuel for domestic and industrial purposes, are composed of vegetable substances, either in a recent, a comparatively recent, or in a fossil state. To the first-mentioned category belongs

* On the Artificial Preparation of Turf, independent of season or weather, and with economy of labour and time. By Robert Mallet, C.E. Dublin: 1845.

wood, to the second peat, and to the third coal. Of these, peat is the least valuable, because the vegetable matter is by no means in a condensed state, and it must undergo a process of drying and preparation before it can be used as fuel. Its constitution, it is true, varies greatly. While that on the surface of a bog is light coloured and spongy, further down it becomes denser and of a deeper brown, and at a great depth (some of the larger Irish bogs are 40 feet deep) it assumes almost the colour and density of coal. The superficial and less valuable kinds of peat are, of course, most common and accessible; and it obviously becomes a most important consideration, how this can be rendered most useful as a fuel. In such a country as Ireland, nearly destitute of wood that could be employed as fuel, and but sparingly supplied with coal, this question becomes especially important; for no less a space than 2,830,000 acres—that is, nearly one-seventh of the entire surface of the island—is occupied with bog. Many continental countries are similarly situated, and in Scotland no inconsiderable extent of area consists of this substance.

The Irish bogs, according to the author of the treatise mentioned above—

> Have hitherto lain waste, among other reasons, because no feasible scheme of reclamation has yet been proposed, that would give to private enterprise a fair return. As these reclamations have usually been conducted, the result could not have been remunerative, from the labour expended—from the small and partial scale of operations—from want of engineering skill—want of co-operation in adjacent landholders—and attempting too high a standard of reclamation at once. In every such case, the whole bog attempted to be reclaimed has been sacrificed as a source of fuel; and in this respect a sweeping measure of universal drainage, as recommended by the Bog Commissioners' Reports, would appear most injudicious. No sooner is a bog thoroughly drained than it is "killed,"—the further growth of peat, and its laying up by nature for future fuel, is at an end; neither is it capable of cultivation; it becomes a mere *caput mortuum*, fit alone for burning, and in the worst possible condition for fuel from its porosity. . . . . The mass of fuel, in the bogs of Ireland, is too great and too valuable to be wasted and lost by a rude method of getting a scanty crop from their surface. If all the bog in Ireland, capable of being made into turf, be taken as low as two millions of acres, and at an average depth of three yards, the mass of fuel which they contain, estimated at 550 lbs. per cubic yard, when dry, amounts to the enormous sum of 6,338,666,666 tons; and taking the value of turf, as compared with coal, at that ascertained in the following pages—viz. as 9 to 54, *the total amount of turf fuel in Ireland*, is equivalent in power to above four hundred and seventy million tons of coal, which, at 12s. per ton, *is worth above two hundred and eighty millions sterling*.—p. 8.

In order to give turf something of the consistency and solidity of coal, by removing its porosity and elasticity, various methods have been tried at different times by different individuals. An obvious method is to employ mechanical power for the purpose of compressing it. Machines for pressing it, sod by sod, by manual labour, have been found to require too much time and

exertion to be used with profit. But when attempted on a large scale, and with powerful machinery, the operation has proved eminently successful. This is the case, in particular, with the process followed by Mr C. W. Williams, in Ireland.

The turf, when fresh cut, has its fibre broken up as far as possible, and is then placed between cloths, and pressed by a hydraulic press of great power. The condensation is about one-third of the volume, and it loses about two-fifths of its weight by the water, which is forced out in the pressing, and subsequently dried out. The sods of turf so prepared, even when formed of the very upper and spongiest stratum of the turf, are denser than wood. They have little or no tendency to grow damp; and it is found that, including all labour, wear and tear, and original cost, this compressed peat can be delivered at the works for 5s. per ton.*

Another method of preparing turf for economical purposes, also invented by Mr Williams, is by impregnating it with tar, after it has been well dried. It is thus rendered waterproof, as it were, having no tendency to reimbibe moisture, and its calorific power is considerably increased. This bitumenising process is not very expensive—from 6s. to 8s. per ton—and the heating power of the materials is said to be little inferior to that of coal.

Turf may also be carbonised, much in the same manner as we do wood, and turf charcoal thus obtained. The individual who first adopted this method of treatment, appears to have been Charles de Lamberville, who describes the process in his "Discours Politiques et Economiques," published in the early part of the seventeenth century. His method of charring consisted of burning a large heap of turf sods, covered with earth, and "stiffling out;" but he admits that the process was not satisfactory, the great falling in of the turf heap by loss of volume in burning, causing the earth covering to get perpetually broken, and thus the stiffling becomes unsuccessful, and the labour of attendance too costly, as well as waste of turf, and incomplete carbonisation. The turf charcoal thus obtained was applied to various purposes of the forge.

The following is Sir Robert Kane's account of the method that ought to be followed:—

The sods must be regularly arranged, and laid as close as possible; they are the better of being large, fifteen inches long by six broad and five deep. The heaps, built hemispherically, should be smaller in size than the heaps of wood usually are. In general, 5000 or 6000 large sods may go to a heap, which will thus contain 1500 cubic feet. The mass must be allowed to heat more than is necessary for wood, and the process requires to be very carefully attended to, from the extreme combustibility of the charcoal. The quantity of charcoal obtained by this mode of carbonisation, is from 25 to 30 per cent of the weight of the dry turf.

The charcoal so obtained is light and very inflammable. It possesses nearly

* Kane's Industrial Resources of Ireland, 2d edit. p. 41.

the volume of the turf. It usually burns with a bright flame, as the volatile matters are not totally expelled. This is shown by a specimen analysed with the following result:—

Carbon, ...	89.90
Hydrogen, ...	1.70
Oxygen and Nitrogen, .	4.20
Ashes, ...	4.20
	100.00

Carbonisation in close vessels has been often practised. This method was in active operation in the Hartz towards the close of last century; the turf being thrown into large cylinders of cast-iron, lighted from beneath at certain apertures capable of being closed, and "stiffled" at top with earth or clay when the combustion had proceeded sufficiently far. The bulk of turf-charcoal thus procured was one-half that of the turf, or 52 cubic feet from 3000 sods of turf. A German author of the name of Pfeiffer describes the process of carbonisation in large retorts, which appear to have been made of hammered plate-iron. In 1792, M. Thorin improved the apparatus for carbonisation in close vessels; and still further improvements are described in the *Annales de Chimie* for 1805, by Platel. According to the mode followed by the latter, the inflammable gases given off are burnt under the carbonising retort, and thus a great economy of fuel results. The char-turf had a greater specific gravity than wood-charcoal.

Mr Mallet is of opinion that neither compressing nor charring turf will be found to answer the end proposed; because the first involves an expenditure in labour which the result does not repay, and as expressing from the fibrous mass of the wet turf, suspended in the water, some of the most valuable parts of the fuel, which is thus lost; the second as replete with difficulty in the process of charring and cooling, and in result rendering a fuel which, in its natural *dry* state, has many useful properties, almost valueless for any purpose, and dissipating uselessly the whole gaseous part of the turf, which constitutes so important a fraction of the whole fuel. He therefore proposes two improvements in the mode of managing turf, which he considers of great importance: 1st, to collect the turf from the bog according to the Dutch method, instead of cutting it in sods as practised in this country; and 2d, drying the turf when so made in suitably constructed kilns, heated by refuse turf or turf mould. As to the former method, he says that it may be expressed in a single sentence; it is in place of ever *cutting* turf from the bank in sods at all, invariably to make "hand turf," as it is called in Ireland.

Wherever there is abundant water in the bog, as is generally the case, the peat mud for this purpose is to be had ready at hand, merely by taking it out of the bog-holes by suitable instruments. Where the drainage is more perfect, or the turf more fibrous, the Dutch method of working, or kneading

with water, so as to make artificial hand-turf, must be adopted. The results of adopting this method are—that from the same peat, turf thus made is about double the density when dry that it can ever be brought to without mechanical pressure, if cut in sods—that the whole labour of turf-making is reduced to merely casting out the peat mud, and spreading it on the surface of the bog, when properly prepared to receive it, and after a short time slicing the semi-dried stratum of peat mud with a fit tool into parallel bands to form the future peats, which, as soon as they are consistent enough to be carried, are transferred to the drying-kiln, by which the whole labour of spreading and turning the sods, and piling, &c., which constitute by far the greatest expenditure of labour in turf-making when cut in sods, are avoided.—p. 42.

The kiln which Mr Mallet has devised for drying turf resembles those which have been extensively and successfully employed for the same purpose at Konigsbrunn, in Wurtemberg; but he conceives that it is better adapted than these for economising fuel in heating, and capital in construction. The following is a general description of this erection; but we must refer to Mr Mallet's treatise for drawings and more lengthened explanations, without which the details cannot be well understood.

The kiln I propose consists generally of a large horizontal flue, or prolonged chamber, through which a slow but constant draft of heated and dried air, gases, &c. passes from one or more fires, placed at one end, and fed with turf mould, or such other refuse bog fuel, and finally is discharged at the other end through one or more vertical chimneys or stalks, to whose height the draft is due. The turf, damp from the bog, or at most only as much air-dried as will permit of its carriage, is piled loosely upon the flat open bottom frames of light trucks, or four-wheeled railway waggons, which are fitted to run upon a light railway laid down and passing through the whole length of the warm chamber or kiln. The wet turf so placed passes into the kiln, at the cooler or chimney end, and as the waggon loads are successively dried, they pass out at the warmer or fireplace end in succession, and their place is supplied by fresh masses of wet turf at the remote end.

Both ends of the kiln are closed, when in use, by common wooden folding-gates, and the draft from the fire passes through another pair of inner gates, formed of wire-gauze upon an iron frame, before entering the chamber of turf; by this means all sparks of fire are arrested, and danger of firing the highly dried turf avoided.—p. 24.

The cost of such a kiln would vary with its dimensions. One of the largest class would be about L.135, besides the expense of 20 turf waggons. One of such a size as might suffice for a single homestead, would not exceed L.95, and would dry about 800 cubic feet of turf per week. A still cheaper, but very effective kiln upon the same general principles, may be constructed on the surface of the bog, and chiefly from materials found there, for the use of cottier tenants.

The advantages afforded by this method of preparing turf are not confined to the saving of labour, and the certainty of obtaining a crop of dry turf. The quality of the fuel is the most important advantage, for it is absolutely dry; and in the process of rapid desiccation, it shrinks to about half its former bulk, and

becomes hard and woody, so that all the ends of the costly compressing process are answered.

Mr Mallet finds frequent occasion to advert to presumed inaccuracies in Sir Robert Kane's most elaborate and valuable work on the Industrial Resources of Ireland. In a publication embracing such a multitude of subjects, and often treating of these in their minutest details, it is scarcely possible to avoid occasional inadvertencies; but these, we are confident, are never of sufficient importance to invalidate the authority of the work, or disturb the general conclusions at which the author has arrived.

On the Progressive Decay of the Potato Plant, and the Means of Removing it. By J. STEWART HEPBURN, Esq., of Colquhalzie, Crieff.—The recurrence of the "Potato murrain" this season at an early period, and in an aggravated form, and the progressive extension of this destructive plague into the districts that have hitherto been exempt from it, with its coincident and still deadlier ravages in other countries, and even in that of its origin, have created a general and reasonable alarm. It is no wonder, therefore, that this mysterious visitation has given rise to earnest and anxious inquiry, and to numerous conjectures and theories as to its origin, and the appropriate remedies. Atmospherical causes—its electrical condition—the peculiarities of the two last seasons—the supposed qualities of the rain that has fallen—parasitical fungi, &c., have all, together or separately, been assigned as the immediate source of the malady. With all deference to the opinions of so many eminent observers, it appears to me that there is something more in it than all this. I am far from denying the operation of one or more of the casualties. But, in my humble judgment, they are of a secondary influence in the case, and that the ultimate natural cause is to be sought for in the altered condition of the plant itself, induced by a long course of high cultivation, which has gradually diminished its vital energy, and rendered it less capable of resisting adverse atmospherical influences.

The potato, as originally brought from Virginia by Sir Walter Raleigh, is stated to have been of a watery or waxy nature, and of small size, little larger than a walnut. In Europe, for a period of two hundred years, it has been subjected to our artificial process of high culture with much manure, which has greatly changed its chemical and structural condition. By this artificial forcing in high-conditioned land, it has been vastly increased in size, and the relative proportion of its constituent principles altered. The proportion of its starch and sugar, both absolute and relative, have been very greatly augmented, and that of its gluten, as I conceive, proportionably diminished. It seems to

me, then, reasonable to suppose, that these material changes of the condition of the tuber to so great an extent from its original state, may have gradually lessened its vitality, and rendered it more susceptible of disease and decay from external causes. For a number of years past we have observed in all quarters, year after year, partial failures of the crop—many of the sets either not vegetating at all, or in a languid and sickly form, and prematurely withering away; and these failures have at length verged into the *murrain*. Again, potatoes have of late become much more liable than formerly to perish in the pits during the winter. In former times, long experience of their hardiness caused them to be treated with very little care. They were with impunity pitted in large unventilated heaps, and stored in cellars, out-houses, and lofts, in large heaps reaching to the cieling—treatment which it would now be madness to practise. Another circumstance lately observed, and indicating, I apprehend, a deficiency of vitality, is the increasing tendency of the sets to remain in the ground undecomposed, and refusing to yield their due nutrition to the stem and root, and the feeble stem prematurely decaying. If I mistake not, there has also arisen in the plant an increased production of flower and seed on the stem; a phenomenon, if it be correct, referable to the law of vegetable life enunciated by that eminent naturalist, the Rev. Dr Fleming, "that plants verging to decay, and threatened with extinction, make a spontaneous effort to continue their species by a temporary increase of fructification."

Such are the principal reasons which induce me to refer the primary natural cause of the potato disease to a progressive decay of vitality in the tuber; and, assuming their validity, I proceed to state my idea, arising out of these reasons, of the most likely means of renovating its constitution, and restoring its vegetative powers. It may be briefly expressed as an attempt to restore the potato, in the first instance, to something approaching to its original condition in point of *size* and *constitution*, so as to obtain, as seed, a *small* and *waxy* tuber, upon which we may commence a new course of cultivation, until a recurrence of the same effects render it necessary to repeat the process. For this purpose I would propose to imitate the self-planting process of nature, by planting *in autumn*, as soon as they are ripe, *whole* tubers of moderate size, in land which has been *slightly* manured in the preceding spring or summer, and the manure *well incorporated with the soil*. The produce of this planting, I would plant in the following autumn, in land slightly stimulated, not with manure, but with *earthy compost*, and the produce of this crop I would plant one or more seasons in *unmanured* land, or allow the potatoes to grow in the land for two successive seasons

without being lifted, merely stirring the surface and keeping it clear of weeds, until a tuber was obtained approaching in nature and size to the original stock from which it sprung in its native soil.* Such a tuber I should expect to prove of a hardy constitution, and possessed of active and vigorous vital energy. The tubers thus obtained, might then be cultivated *with manure* (in moderate quantity) until their edible qualities were restored.

It appears that all the varieties of new seedling potatoes are as liable to the disease as the stock from which they sprung; as might indeed have been predicated, for every seed produces its own kind—a vigorous offspring is not to be expected from a parent of enfeebled constitution. It seems, therefore, desirable to attempt, by an experiment so simple and easy as that which I have proposed, the renovation of the constitution of the existing stock of potatoes, by conducting them back towards their primitive condition before it was materially altered by the processes of modern culture.

Effect of a Mixture of Peat, Charred Peat, and Peat Ashes. By Mr Peter Mackenzie, West Plean, Stirling.—For some years past I have been trying experiments with peat, charred-peat, and peat-ashes, as a substitute for stable manure, and for many kinds of crop grown by farmers and gardeners. These substances, when easily obtained, I find to be very useful, and perhaps the following notice may be of use to some readers. In the spring of last year, I collected a quantity of peat for various purposes, and part of it was intended to be charred or burned. It was not so well prepared for burning as I would have wished, a good deal of moisture being in it; however, a good fire was made of wood to begin with, and as the peat dried, it was drawn to the fire, and in this way it was kept burning for two weeks. It required little watching, only once or twice in twelve hours. The partially dried peat was drawn to the fire, because it was intended to have a quantity of charred-peat and ashes mixed together, and in order to obtain both, the fire was kept in a smothered state to char the peat, but during the night it commonly burst through in some parts, and these supplied the ashes. When we had a quantity to begin with, the unburnt peat and the charred, with the ashes, were all mixed well together by turning them several times over; and though I cannot state the exact proportion of each, one half at least was unburnt peat.

This mixture was applied to land about the beginning of May; the soil sandy, and the crop Swedish turnips. The ground was

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* Perhaps the process proposed might be safely abridged by omitting the first year's planting in slightly-manured land, and allowing the potatoes planted with earth compost, to remain vegetating one or two years in the ground.

drilled, and the manure put into the drills and afterwards covered, the seed being sown above it. The quantity used was at least at the rate of two hundred bushels per acre, which may be thought a large quantity, when twenty bushels of peat-ashes have been recommended to manure an acre of land. We tried it against well-made stable manure like mould cut well with the spade, which was applied at the rate of about twenty tons to the acre, and spread into drills like the peaty mixture. The plants grew well in both cases. We tried to ascertain the amount of produce per acre from each manure as late as the middle of January 1846, for, from the mildness of the season, the turnips till then appeared to be in a growing state, each plant having had about two square feet of surface to grow upon, and the surface was kept flat, and the ground chiefly worked with the Dutch hoe. The weight of bulbs fit for use, manured with the peaty mixture, was upwards of forty tons per acre, while those produced from stable dung weighed only about thirty tons; and both would probably have been greater, had they not been somewhat shaded by dwarf marrowfat peas that grew on each side of the turnips. One row of the peas was also manured with the peaty composition, and yielded as great a crop as those manured with stable manure. Such a mixture may be expensive if required to be carried a great distance, but, in many places, it could be obtained at small cost, and the materials of which it is composed are of such a nature as to benefit the land for some time to come.

In the *Gardeners' Chronicle*, charcoal is said, by a high authority, to be a valuable addition to most manures. Its open, porous nature renders it peculiarly useful when mixed with rich manures abounding in ammonia, in preventing the loss of that volatile substance. By the gradual action of the air on this peaty mixture, it yields certain gaseous matters requisite to plants, and moreover contains all those substances which render wood ashes valuable as manure. The following analysis of peat-earth, by Sprengel, shows that some peat contains valuable matter:—100,000 parts of dry peat-earth contain

7,960	parts of	Silica.
760	...	Lime, (Carbonate of)
160	...	Magnesia, (Carbonate of)
620	...	Alumina.
320	...	Gypsum.
40	...	Phosphate of Lime.
60	...	Common Salt.
120	...	Oxide of iron and manganese.

The good effects of wood and peat-ashes upon certain crops, both at home and abroad, are too well known to be noticed by me; but I may say, that the combination of peat, charcoal, and ashes, may be used to a much greater extent in this country than they are

*Kane's Industrial Resources of Ireland.**—Such a work as this is calculated to be of eminent service to Ireland at the present time. The resources of that beautiful island have long been known to be great; but this knowledge has been hitherto vague and comparatively unprofitable; it is only by an intimate acquaintance with its natural production, the physical features of the country, and general capabilities, that its advantages can be appreciated and readily turned to account. Professor Kane is eminently fitted for the task he has undertaken, and the manner in which he has executed it is beyond all praise. The subject of promoting the development of industry and industrial knowledge in Ireland, is one which he has taken up and steadily pursued, as the well-considered object of his life. A skilful chemist, and conversant with many other branches of knowledge applicable to such an investigation, he was competent to engage in actual experiment, and bring to the test of trial, what most authors would have been obliged to receive on the faith of others. The position he holds in society, and his connexion with the principal scientific associations of Ireland, afforded him facilities for obtaining information and collecting materials; and numerous individuals, accordingly, on becoming acquainted with his object, with the utmost readiness placed specimens and documents belonging to their separate departments, at his disposal, without which his work could not have been rendered nearly so copious and satisfactory as it now is. In consequence of these advantages, the work will be found to be a repertory of important facts and valuable statistical information, along with the results of numerous scientific investigations, and discussions on the moral questions which affect the state of industry in Ireland. A useful and interesting feature of the work is a series of maps illustrating the geological structure of Ireland, the elevation of its surface, the distribution of bog and drainage, and the means of internal intercourse.

It is not, of course, expedient for us to attempt an analysis of a work embracing so many different subjects, and such a multiplicity of details; but we may select a single passage by way of specimen, as it readily admits of being insulated from the accompanying matter.

In discussing the general question of the relations of scientific knowledge to the pursuits of industry, I have spoken of industry more as regards manufactures than agriculture, because it simplified, in a corresponding degree, the conditions of the question, and enabled me to treat of it more briefly. Every argument proving the necessity of knowledge to the manufacturer, applies, however, to the agriculturist; and as, in the existing circumstances of Ireland, manufacturing industry can only come into play by slow degrees, it is by improvements

* Industrial Resources of Ireland. By Sir Robert Kane, M.D. Second Edition. Dublin: 1846.

in agriculture, for which education is absolutely necessary, that the most rapid and most extensive amelioration in the condition of the people must be effected. Agricultural education is, therefore, the object on which immediate attention should be concentrated in this country. It should, like other industrial education, consist of the general scientific discipline which has been already described, and be perfected by the practical education of a well-conducted farm. For the commencement of this education, the arrangements of the Royal Dublin Society are eminently adapted, and the co-operation of the Royal Agricultural Society, which embodies almost every landed interest in Ireland, will be a most powerful stimulus to those who have to live by agriculture, to avail themselves of such means of increased knowledge. The practical education of the farmer or land-steward can be completed in those schools, of which so many are now in operation, or about being formed, as at Templemoyle and Lough-Ashe. That contemplated on a larger scale at Leopardstown, cannot fail, if carried out on a proper plan, to be of great utility. We will hear no more of the superiority of Scotch farming, or of the exclusive employment of Scotch stewards, if Irishmen set themselves about learning their trade as well, and fit themselves, by steadiness and practical knowledge, for such situations.

That these views are in no material degree unsound, is fully shown by the fact that the commissioners of education have, in organizing the plan of instruction for the poorer classes, always considered industrial education as a necessary element of their system. What can be of higher beneficence to a population than the instruction of the child in the general principles of the trades, by one or other of which the man will have to support a family. This object, however, could not be fully carried out by the means hitherto available; and hence the commissioners have, for reasons which have been described above, concentrated their efforts upon agricultural education. Even in this, their plans cannot be yet fully brought into play. The schoolmasters have to learn the principles of agriculture before they can teach them; and this education of the educators is the step now in progress of working out. The scientific lectures, by eminently qualified teachers; the practical workings on the model farm, under the directions of a highly skilful agriculturist, will, after a little time, enable the commissioners of education to settle in each parish a schoolmaster who will also be a minister of industrial progress, and by whose precepts and example, the seed of practical intelligence shall be cultivated, and return a hundred fold. With such a system of education, and with the habits of temperance, of moral conduct, and fixity of purpose, which, it is acknowledged, are growing rapidly upon the Irish character, there is no fear for the working classes. It is the middle classes that have most difficulties to overcome, most bad habits to break from. I have endeavoured to indicate to them at once the sources of material prosperity which the country possesses, and the means by which alone, as I conceive, they can acquire the power of properly utilizing them.

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The causes that have led to the bad results of the manufacturing system in the sister kingdom, (namely, the moral and physical degradation of the population in the large manufacturing towns of England,) do not exist with us. Ireland can never become a great manufacturing country such as England is. Her physical constitution does not supply materials. The proportion of the people employed in factories can never, therefore, be so great. Her sources of power, whether it be of coal, turf, or water, lie distributed so uniformly through the land, that the concentration of manufactures on a few localities, as in England, cannot occur. Hence the evils of vast, unhealthy, manufacturing cities need not be feared. Above all, with temperate habits, and with the education which the national system will give to every individual of the growing race, there is no danger but that industry may be accompanied by intelligence, intelligence by morality, and all by the steadiness of purpose and tranquillity of habits on which the happiness of the family and the peace of the community depend. This is the result which it should be the object of all to gain. This would render us independent of the wretched political differences on which we waste our strength.—p. 425.

General and Quarterly Averages of Temperature for several Years at Hopetoun House, Scotland. By Mr James Smith, Hopetoun Gardens.

1.—General Average of the Thermometer (Fahr.) at Hopetoun House, West Lothian, from the 1st January 1820 to the 31st of December 1845, taken at 9¼ a.m., and 8½ p.m., at 100 feet above the level of the sea, including 26 years.

	Monthly.												Yearly.
	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
1820	28¾	36¾	37¾	43	49	55¼	58¼	56¾	52¼	43¼	40¾	38¾	45⅐
1821	36¼	37⅛	40	46¼	47⅞	54¼	59¼	58¼	56	50¾	41¼	39	47⅐
1822	39	40¼	42¼	46	53¾	60¼	59¼	58¼	50¾	46¾	42¾	34¾	47¾
1823	32¼	33	39¼	43¼	51⅕	54¼	56¾	55¼	51⅗	44¾	44¼	36	45⅐
1824	38¼	38¼	38¼	45	51	56¼	59¾	57	53¼	44¾	38¾	37⅟₁₂	46⅓
1825	37¾	37¼	39¼	45¼	50	55¾	62⅝	60¾	57⅙	48¼	37	36¼	47¼
1826	32	39¾	39¼	46	51⅝	63	63⅛	59⅖	52⅝	47	35⅝	39¼	47½
1827	34¼	32¼	47¼	44	51¼	57¼	59¼	57¼	53¾	49¼	39¾	40⅓	47⅐
1828	37¼	37	41	44	51⅞	58⅝	60⅙	57¾	53¼	46	42¾	42	46⅐
1829	29¾	35⅞	37¼	41¼	51¼	57¼	59¼	55⅝	48	44	36¾	34¾	44¼
1830	32¼	33	42⅝	46	51¾	54¾	59¼	53¾	50⁷⁄₁₂	47¼	40¼	33⅛	45⅞
1831	32¾	35⅝	41	45⅝	49	59	60	58⅕	52¾	50¾	37¾	38¾	46¾
1832	36	37	39¾	44¼	49¾	56¼	58	56¼	52¾	47⅟₁₂	38¾	37⅓	46⅐
1833	31	37¼	36¾	43¾	54¼	55	58¼	54¼	51¼	46	39⅟₁₂	37¼	45⅗
1834	38¼	37⅜	40¼	43¼	52	56¾	59⅝	58¼	52¼	46¾	40¼	38⅐	47
1835	35⅛	38¼	39¼	45¼	48¼	55	57¾	59	51¼	42⅝	39¼	36¾	45⅐
1836	36	34⅝	37¼	41¼	50¼	55¼	54¼	53⅝	50¾	42⅝	37¼	36¾	44¼
1837	32¾	36¼	33	37⅛	49¼	57¾	60	55⅛	50⅛	46¼	37¾	38¾	44⅐
1838	27⅞	26¾	36⅝	40⅛	47¼	54¼	58	56⅛	51	43⅝	36¼	37	43½
1839	32⅛	34¼	34¾	41¼	48¾	56	58	55¼	50⅜	45¼	40¼	34⅐	44¼
1840	35¼	34¼	37¼	47	48⅛	55¾	56¼	58⅛	49¼	43¼	38⅓	34⅐	45
1841	30¼	36¼	43¼	44¼	53	54	55	55¾	53¼	43	36	36	45
1842	31⅞	37	39¼	43¼	50	57	57	59	53¼	43¼	38¾	43⅐	46
1843	35¾	31⅝	37¾	44	46¼	52¾	57	57¼	56¼	43	38	43⅐	44¾
1844	35¾	32¼	37⅛	48¼	52	57	58⅞	55¾	53	46	41¼	32⅕	45¾
1845	33¾	33	36	45¼	49¼	57¼	56¼	57	51⅛	46¾	41¼	35⅐	45¾
Average	33¼	35⅝	38¾	44	50¼	56¼	58⅞	57	52¼	46	39	37⅓	45¾ nearly.

2.—QUARTERLY AVERAGES.—SPRING includes Februa and April; SUMMER, May, June, and July; Au gust, September, and October; WINTER, Nov cember, and January.

	SPRING.	SUMMER.	AUTUMN.	WINTER.	YEARLY.	The fineness of the more on the heat Autumn than the temperature of th
1820	39¼	54½	51	35⅔	45½	Nearly an Aver
1821	41	54	55	39	47¼	Warm Autumn.
1822	43	57⅓	52	38½	47½	Early and Warn
1823	38½	54⅙	50⅔	37⅙	45¼	Rather late and
1824	40¾	55¾	51⅞	38	46¼	Above an Avera
1825	40¾	56⅙	55⅙	37	47¼	Warm and Dry.
1826	41¾	59⅓	53	35¾	47¼	} Warm and E
1827	41¼	56	53⅓	38⅙	47¼	} Chestnut ri
1828	40⅔	56¾	52¼	40½	47¼	Early and Warn
1829	38	56	49	37	44⅓	Below Average.
1830	40¼	55⅓	50½	35¼	45¼	Average.
1831	40⅓	56	54	36½	46¾	Above Average.
1832	40⅛	54¾	52⅔	37¼	46⅛	Above Average.
1833	39¼	56	50¼	34	45⅚	Average.
1834	40	56	52¼	39	47	Early and Mild.
1835	40¼	53¾	51	37	45½	Average.
1836	38	53⅓	49	36¾	44¼	Late and Damp.
1837	35¾	55⅔	50¼	36¼	44½	Late and Cold.
1838	37½	53¼	50¼	33⅔	43¼	Very late and C
1839	37	54	50⅓	35⅔	44¼	Late Season.
1840	39¾	53⅓	50¼	36	45	Average, } nearl
1841	41¼	54	50¾	34	45	Average, }
1842	39¾	54½	52	38	46	Rather Mild.
1843	35¾	52	52¼	39	44¾	Below Average.
1844	39¼	56	51⅔	36¼	45¾	Average.
1845	38	54¼	51¾	36⅔	45½	Nearly Average
Average	39½	55½	51¼	36¾	45¾	

*Porter's Experiments with Manures.**—This essay gained the first prize of the Garioch Farmer Club, and is published at their request. It is well written, modestly expressed, and contains many judicious criticisms on the manner in which most of the operations of the field are usually performed. It treats of the effects of certain extraneous manures, in comparison with farm-yard dung, on various crops. We cannot relate every particular noticed by Mr Porter; for that would necessarily imply a transcription of the whole of his essay; but we shall notice a few. In regard to *potatoes*, he prefers planting whole moderate-sized potatoes to cut sets, and gives the superior result of 14 tons 14 cwt., over 13 tons 10 cwt. 1 qr., with the same quantity of well prepared farm-yard manure. Of drills at different widths, he found those 36 inches apart yield 37 bolls 1 firlot 2 pecks per imperial acre, while those at 30 inches produced 34 bolls 1 peck, under similar circumstances. Plucking the blossom off the potato stems seemed to give an increase of $1\frac{3}{4}$ firlot in the acre. From a statement in an agricultural paper, recommending *turnip* plants to be wide hoed, Mr Porter tried an experiment, and the result was, that the narrow hoed at 8 inches gave a crop of 15 tons 19 cwt. 1 qr. 20 lb. per acre; while the wide hoed of 11 or 12 inches produced 14 tons 13 cwt. 2 qr., leaving a balance in favour of narrow hoeing of 1 ton 5 cwt. 3 qr. 20 lb. per acre. It is known that wide hoed turnips grow the larger, but do not weigh to their appearance. His observations on the necessity of singling the turnip plants, at first hoeing, and of performing the operation of singling at all times with extreme care, are very correct; and such precepts as these inculcate true economy. The ploughing in of turnip tops gave an increase of Hopetoun oats of 5 bushels 3 pecks of grain, and of 3 cwt. 2 qr. of straw per acre. The depth to which seeds should be harrowed into the soil is an important point of practice in agriculture. Mr Porter tried the vegetative powers of several grass and turnip seeds from various depths—and at $1\frac{1}{2}$ inches deep, perennial rye-grass brairded fully $\frac{1}{3}$ of the seeds sown, Italian rye-grass $\frac{1}{2}$, meadow fescue $\frac{2}{3}$, hard fescue $\frac{18}{20}$, Timothy fully $\frac{1}{2}$, crimson clover $\frac{17}{20}$, red clover $\frac{1}{2}$, white clover nearly $\frac{1}{3}$, Swedish turnips nearly $\frac{2}{3}$, and yellow turnips $\frac{1}{4}$; while at 3 inches deep, none of them brairded at all, except perennial and Italian rye-grass. The practical result is, that from $\frac{3}{4}$ to $1\frac{1}{2}$ inch deep, most seeds are sure to vegetate well.

* Report of Experiments on Manures, &c., made on the farm of Logie-Elphinstone, Aberdeenshire, during the years 1844-5. By James Porter, Farm-overseer. Printed by desire of the Garioch Farmer Club. Aberdeen: 1846.

ACCOUNT OF THE GREAT ANNUAL MEETING OF THE HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND AT INVERNESS IN SEPTEMBER 1846.

The annual meeting of the Highland and Agricultural Society was held this year, 1846, at Inverness, on Tuesday, Wednesday, and Thursday, the first, second, and third of September.

The site chosen by the Local Committee for the exhibition was the Academy Yard, the area before and behind Dr Bell's School, and the small intervening park belonging to Mr John Mactavish. The Academy Yard contained the stalls for the West Highland and Short-horn cattle, all the pens for sheep, the Ladies' gallery, the stand upon which the prize animals are exhibited and named, and the Pavilion for the great dinner; the intervening field afforded accommodation for the stalls of the polled and horned cattle of other breeds; and in the area behind Bell's School the horses were all placed by themselves; while the space in front of the school was occupied with implements, butter and cheese, roots, plants, and seeds, and specimens of the clan tartans exhibited by Dr Nicol and Mr Macdougal of Inverness.

Though the general view of the show was somewhat circumscribed by the height of the walls between the fields, it was acknowledged by many present that a more compact and convenient show-yard within its bounds, and one more accessible from all points, had not been seen any where else. It was Mr Slight, the Society's engineer, who furnished the plan of the show-yard which afforded so much accommodation in so small a space.

The business of the meeting was thus arranged and sanctioned by the Local Committee and Deputation of Directors. On Monday much preliminary matter was prepared, and the Judges of implements, dairy produce, and of roots and seeds, appointed. On Tuesday morning the Agricultural Chemistry Association met their friends at a public breakfast in the rooms of the Northern Meeting, and the subject proposed for discussion was, "On the use of prepared food in feeding cattle; and the mode of improving hill pasture and hill land generally." In the forenoon of the same day the exhibition of implements, of butter and cheese, and of roots and seeds, were inspected by the judges, who immediately thereafter awarded the premiums in their respective departments.

In regard to the various articles entered in competition this day, it could not fail to be generally remarked that the exhibition of implements was of very limited description, the entries being not only few in number, but many articles entered were not brought forward at all. The great distance of Inverness from localities in the south, in which the most eminent makers

of implements reside, no doubt deterred them from incurring the unavoidably great expense of so long a journey. However natural such a resolution might be, it is to be regretted that it should have deprived the farmers of the north of the opportunity of inspecting a large collection of implements, of superior construction, perhaps, than any they may chance to possess. The implements that seemed to us to attract particular notice were a very cheap double-blast fanner, made by John Wightman, Ballymiglaff, near Comber, in the county of Down, Ireland, who stated a curious fact, that the principle of the double-blast was applied to the fanner by the late David Kennedy, Ballymiglaff, so long as sixty years ago; a churn, by Alexander Weston, Liverpool, which made butter by the agitation of the milk being caused by a strong current of air being propelled through it; Ainslie's drain-tile machine, which is remarkable for the simplicity of its construction; a steelyard, which weighed objects with great accuracy; and sympathetic gates for the enclosure of roads crossing railways, which, by the action of simple crank machinery placed under ground, open or shut simultaneously, when any one of them is so moved by the hand. The two last-named articles were manufactured by W. and C. Young, 128, High Street, Edinburgh. All the butter produced, with the exception of one lot, was highly creditable to the district. The natural pasture of the Highlands seems to impart great richness and delicious flavour to the butter produced from it. Some of the cheese would have done honour to an English dairy. The exhibition of roots and seeds was small, the period of the show being too early for the production of the fruits of the fields of the current year. As usual on all these occasions, the collection of Messrs Lawson and Son, Seedsmen to the Society, stood conspicuous.

The judges in these classes were :—

Of Dairy Produce.—Baillie Ross, Mr Simon Frazer, and Mr A. Macdonald, Inverness. Attending Member, Mr Baillie of Dochfour.

Of Seeds, Roots, and Plants.—Mr Ross, Kinnahaird; Mr William Murray, Kilcoy; and Mr Shirreff, Barnyards. Attending Member, Mr George Anderson.

Of Implements.—Lord Berriedale; Mr Smith, late of Deanston; Mr Slight, Curator of the Society's Models; and Mr H. Stephens, Editor of the Journal of Agriculture. Attending Member, Mr Wardlaw Ramsay of Whitehill.

Their awards were as follows:—

FOR IMPLEMENTS.

For any New and Useful Agricultural Implement or Machine that has been satisfactorily tested in actual work, five sovereigns. (No entry.)

For the Subsoil Plough best suited to accomplish the main objects of Subsoil Ploughing, viz., moving, breaking, stirring, and effectually detaching the subsoil from its own substratum, without bringing it to the surface, five sovereigns. (No entry.)

For the best Subsoil Grubber, three sovereigns. (No entry.)

For the best Two Horse Plough, either of wood or iron construction; work-

manship, ease of draught, and effects in lifting and turning over the furrow, being all considered, five sovereigns. To John Stewart, smith, Beaufort Inverness-shire, three sovereigns.

For the best Winnowing Machine or Barn Fanner, four sovereigns. To John Wightman, Ballymiglaff, county Down, Ireland, three sovereigns, and the silver medal.

For the best Single Horse Cart, with Wheels and Axle adapted to farm purposes, five sovereigns. To Roderick Fraser, carpenter, Conan Bridge, Ross-shire, three sovereigns.

For the best Implement of any kind used in the cultivation of the Turnip or Potato crop, five sovereigns. To Jas. Arres, Culloden, near Inverness, three sovereigns, for a Turnip Sower; also to John West, Lundie, near Dundee, for his Improved Turnip Drill, two sovereigns.

For any Useful Improvement in any of the Utensils used in Dairy Husbandry, four sovereigns. To Alex. Weston, Liverpool, for an Atmospheric Churn, three sovereigns.

For the best set of Models, or of Specimens of any Improved, Certain, and Economical Method of Constructing Drains, for the Drainage of Land, whether by means of Tiles or Pipes of Burnt Clay, of Peat Moss, Wood, or Stone, or any combination of these, five sovereigns. (No entry.)

For the best set of Apparatus, either of full size or in Model, for Dipping or Bathing Sheep, three sovereigns. To Thos. Bigg, 15 Crawford Street, Portman Square, London, a medal; and to William Thompson, Over-Roxburgh, one sovereign.

For a Model for the Effectual Washing of Sheep, with Short Description of the Mode of Conducting the Process, three sovereigns. To Robert Boyd, Innerleithen, two sovereigns.

For the best set of Cart and Plough Harness, three sovereigns. To George Mackenzie, Inverness, two sovereigns.

For approved Patented Articles, and for Articles not embraced in any of the foregoing sections, the Judges awarded a medal to F. Macneill and Co. of London, for their specimens of Patent Felt.—To John Ainslie of Alperton, Middlesex, for his Drain Tile Machines, a medal.—To John West, Lundie, near Dundee, for his Seven-Teeth Grubber, a medal.—To W. and C. Young, High Street, Edinburgh, for their general exhibition of Wire Fences, &c., a medal.

We ought to mention that Messrs. Macneill and Co. obligingly gave the free use of a quantity of their asphalted roofing felt, sufficient to cover the entire roof of the Ladies' Gallery.

An experiment with Mr Weston's Atmospheric Churn was tried. The Machine was made to act upon milk warm from the cow, with a small portion of one night's cream; and butter was formed in twelve minutes.

FOR DAIRY PRODUCE.

1. CURING BUTTER.

To the owner of any Dairy who shall have made and cured for keeping through the season, the best quality of Butter for the market, not being less than two cwt., in 1846, five sovereigns—John Rose, Kirkton, near Inverness.

For the second best quality of ditto, three sovereigns—W. Kennedy, Stron-[illegible] Argyleshire.

2. MAKING CHEESE.

To the person who shall produce the best specimen of Sweet or Full Milk Cheese, made of any variety that he finds most profitable for the market, five sovereigns—James Ure, Maryburgh, Ross-shire.

For the second best ditto, three sovereigns—Mrs Jesse Barclay, Calcots, near Elgin

[illegible] any Dairy who shall have made, for sale, during the season

1846, the best quality of Cheese from Skimmed Milk, not being less than one cwt., five sovereigns—James Ure, Maryburgh, Ross-shire.

For the second best ditto, three sovereigns—Mrs Jesse Barclay, Calcots, near Elgin.

A sample of excellent butter, of quality equal to that which carried the first premium, was exhibited by S. M. Boulderson of Erchless Castle, but was too late to be entered for competition. The Cheese exhibited by Mr Boulderson, also too late for competition, was superior to any which gained the premiums.

FOR ROOTS, SEEDS, AND PLANTS.

Very fine field Turnips, exhibited by James Ormiston, experimental farm, near Lochgilphead, Argyleshire; Purple-topped Globe Turnips, by Robert Trotter, Garguston, Ross-shire; Seedling Potatoes, especially the red and white kidney varieties, by Eneas W. Mackintosh of Raigmore, Inverness-shire; a Third Cutting of Clover in 1846, by Colin Chisholm, Millburn, Inverness-shire; Perennial Ryegrass Seed (weighing 30 lbs. 14 oz. per imperial bushel), by James Mackillican, Piperhill, co. of Nairn; Turnip Seeds, by Alexander Mactavish, Ness Park, Inverness; the collection of Plants and Seeds of Pines, by John Grigor & Co., Forres, co. of Moray, particularly the one and two-years-old Seedling Native Highland Scots Pine Plants, &c. were all commended. The collection exhibited by Peter Lawson and Son, Edinburgh, as Seedsmen to the Highland and Agricultural Society, was noticed by the Judges as entitled to the highest praise. It consisted of an extensive assortment of the various Grasses and other herbage plants used in agriculture; specimens of the numerous varieties of the Cereal Grains, with samples of the produce of 1846; a fine specimen of the Tussac Grass of the Falkland Islands, and several of the tubers of *a Potato, free of disease,* from Pisa in Italy. They also exhibited a collection of the hardy Coniferæ, suited to this climate, including the *Cryptomeria Japonica,* the latest introduction from China; with several other new and rare species of plants.

In the afternoon of Tuesday the Local Committee, along with the Directors and gentlemen connected with the counties of Inverness, Elgin, Nairn, Ross, Sutherland, Caithness, and Cromarty, held a meeting in the Academy Hall, under the presidency of Mr Macpherson Grant, younger of Ballindalloch, Chairman of the Committee, to appoint the Judges and the numerous Sub-committees to discharge the various duties incidental to the exhibition of the stock on the following day. The Committee, afterwards, in company with many members of the Society, partook of a sumptuous dinner in the Northern Rooms, prepared by Mr Grant of the Caledonian and Union Hotels, Mr Grant, younger of Ballindalloch, in the chair. In the evening, Mr Smith of Deanston delivered a lecture on thorough draining, illustrated with large drawings, in the court-room of the County Buildings. The following are the names of the gentlemen appointed judges this day:—

Of the West Highland Breed.—Mr M'Neill of Colonsay; Captain Campbell, yr. of Jura; Mr Stewart of Achadashenaig; and Mr Middleton of Davidston. Attending member, Mr Ainslie of St Colme.

Of Extra Stock of do.—Mr Robertson of Kinlochmoidart; and Mr Mitchell, Inverscaddle. Attending member, Mr Macdonnell of Morar.

Of Short-Horns.—Mr Grey, Dilston; Mr Watson, Keillor; and Captain Barclay Allardyce of Ury. Attending member, Mr Baillie of Dochfour.

Of Aberdeen, Angus, and Galloway Polled Breeds.—Mr Walker, Wester Fin-

tray; Mr Fernie of Kilmux; and Mr Elphinstone Dalrymple, Logie Elphinstone. Attending member, Mr Smith of Deanston.

Of the Ayrshire Breed.—Mr Black, Dalkeith Park; and Mr Clark, Dysart. Attending member, Mr Matheson of Ardross.

Of the Aberdeenshire Horned.—Mr Simpson of Cobairdy; and Mr Brown, Linkwood. Attending member, Mr Brodie of Lethen.

Of any Breed and Crosses.—Mr Watson, Keillor; and Mr Simpson of Cobairdy, Attending member, Mr Brodie of Lethen.

Of Horses.—Mr Hay Mackenzie of Cromertie; Mr Wallace of Kelly; Major Houston; and Professor Dick. Attending member, Mr Dempster of Skibo.

Of Blackfaced Sheep.—Mr Kennedy of Kirkland; and Mr Brown, Linkwood. Attending member, Mr Gunn, Rhives.

Of Cheviot Sheep.—Mr Murray, Drochill Castle; and Mr Aitchison, Mension. Attending member, Mr Alexander Mactavish.

Of Leicester Sheep.—Mr Grey, Dilston; and Mr Black, Dalkeith Park. Attending member, Mr Alexander Mactavish.

Of Southdowns and Crosses.—Mr Brown, Linkwood; and Mr Clark, Dysart. Attending member, Mr Matheson of Ardross.

Of Extra Sheep and Goats.—Mr Kennedy of Kirkland, and Mr Brown, Linkwood.

Of Swine.—Captain Mackay Sutherland of Aberarder; and Dr Mackenzie, Kinellan. Attending member, Mr Stephens.

Poultry.—Mr Elphinstone Dalrymple; and Captain Mackay Sutherland. Attending member, Mr Stephens.

The gates were opened for the admission of the stock by five o'clock on Wednesday morning, and the stock were all placed in their respective stalls by eight o'clock, in readiness for the judges. The show-yard was then cleared of every person except those in charge of the stock, by the active and personal exertions of the new Secretary of the Society, Mr Hall Maxwell, younger of Dargavel, in order that the judges might meet with no inconvenience from curious intruders during their inspection of the stock. The enforcement of this salutary rule afforded great satisfaction to the judges, who on no former occasion executed their duties with so much ease and comfort both to themselves and the stock.

These are the awards of the judges on the various descriptions of stock :—

CATTLE.

WEST HIGHLAND BREED.

Of this breed were entered in competition 222 head; namely, 28 bulls, 37 cows, 27 calves, 40 heifers, 36 oxen, 24 stot stirks, and 30 queys. The north and west of Scotland being the seat of this beautiful and useful breed of cattle, the exhibition was expected to be large in number, and excellent in quality.

For the best Bull, calved between 1st January 1840 and 1st January 1844, enty sovereigns—The Marquis of Breadalbane.

For the second best ditto, ten sovereigns—Donald Stewart, Luskintyre.

The Honorary Silver Medal [illegible] John Anderson, Braes of Foss—as the *Breeder* [illegible] best Bull

For the best Bull, calved after 1st January 1844, seven sovereigns—William Grant, Ruthven, Tomintoul, Banffshire.

For the best breeding Cow, not exceeding eight years old, which has reared a calf during the season of the Show—the calf to be shown, ten sovereigns—John Cruickshank, Cloves, Elgin.

For the second best ditto, five sovereigns—The Marquis of Breadalbane.

For the third best ditto, three sovereigns—The Duke of Sutherland.

For the best three Cows, reared and bred by the Exhibitor, which have had calves during the season of the show, with their calves at their feet, fifteen sovereigns—The Marquis of Breadalbane.

For the best two Heifers, calved after 1st January 1843, ten sovereigns—The Duke of Sutherland.

For the second best two ditto, five sovereigns—The Duke of Sutherland.

For the best two Heifers, calved after 1st January 1844, seven sovereigns—The Marquis of Breadalbane.

For the second best two ditto, three sovereigns—William Grant, Ruthven, Tomintoul.

For the best two Oxen, calved after 1st January 1842, ten sovereigns—John Cruickshank, Marcassie, Tarves.

For the best two Oxen, calved after 1st January 1843, seven sovereigns—The Duke of Richmond.

For the best two Oxen, calved after 1st January 1843, which have never been housed nor confined in the straw-yard since Whitsunday 1844, seven sovereigns—John Cruickshank, Cloves.

For the best two Oxen, calved after 1st January 1844, five sovereigns—The Duke of Richmond.

For the best lot of Stot Stirks, not fewer than *six*, calved after 1st January 1845, bred by Exhibitor, seven sovereigns—Daniel Gilchrist of Ospisdale.

For the best lot of six Queys, calved after 1st January 1845, bred by Exhibitor, seven sovereigns—Daniel Gilchrist of Ospisdale.

SHORT-HORNED BREED.

Of this celebrated and favourite breed of cattle only 37 head were entered in competition, namely, 18 bulls, 11 cows, and 8 heifers. It is worthy of remark, however, that a bull was here shown, the one belonging to Mr Mason Hopper, which, without the least difficulty, obtained the first premium, is a bull that has earned for himself the highest character of any short-horn bull that was ever exhibited, inasmuch as during this season, in the course of a few weeks, he has carried the first premium of the English Agricultural Society at Newcastle, of the Yorkshire Agricultural Society at Wakefield, of the Irish Agricultural Society at Limerick, and lastly, of the Highland and Agricultural Society at Inverness. For these reasons, the Society very properly determined on adding the portrait of this bull, of so much distinguished merit and high character, to their picture gallery, and Mr Gourlay Steell of Edinburgh was accordingly commissioned to paint the portrait.

For the best Bull, calved between 1st January 1840 and 1st January 1845, twenty sovereigns—John Mason Hopper, Newham Grange, Stockton-on-Tees, Yorkshire.

For the second best ditto, ten sovereigns—The Duke of Richmond.
To the *Breeder* of the best Bull in this section, the Honorary Silver Medal—to the said John Mason Hopper.
For the best Bull Stirk, calved after 1st January 1845, ten sovereigns—William Hay, Shethin, Tarves, Aberdeenshire.
For the second best ditto, seven sovereigns—William Tod, Elphinstone Tower, Haddingtonshire.
For the best breeding Cow, of any age, having reared a calf during the season of the show, ten sovereigns—Alexander Lawson, Oldmills, Elgin.
For the second best ditto, seven sovereigns—Alexander Sutherland, Shempston, Elgin.
For the beft Heifer, calved after 1st January 1844, seven sovereigns—William Tod, Elphinstone Tower, Haddingtonshire.
For the best two Heifers, calved after 1st January 1845, five sovereigns—William Hay, Shethin, Tarves.
For the best pair of Oxen, calved after 1st January 1843, ten sovereigns. (No entry.)
For the best pair of Oxen, calved after 1st January 1844, ten sovereigns—(No entry.)

ABERDEEN, ANGUS, AND GALLOWAY POLLED BREEDS.

Of all these, there were only 54 head entered in competition, namely, 13 bulls, 15 cows, 12 heifers, and 14 oxen.

For the best Bull, calved between 1st January 1839 and 1st January 1844, twenty sovereigns—Hugh Watson, Keillor, Forfarshire.
For the second best ditto, ten sovereigns—Robert Walker, Portleithen Mains, Aberdeenshire.
To the *Breeder* of the best Bull in this section, the Honorary Silver Medal—the said Hugh Watson.
For the best Bull, calved after 1st January 1844, ten sovereigns—A. T. F. Fraser of Abertarff, Inverness-shire.
For the best Cow, calved previous to 1st January 1843, having reared a calf during the season of the show, ten sovereigns—Alexander Craig, Kirkton, Sutherlandshire.
For the second best ditto, five sovereigns—James Campbell Brodie of Lethen.
For the best two Heifers, calved after 1st January 1843, ten sovereigns—Alexander Craig, Kirkton, Sutherlandshire.
For the second best ditto, five sovereigns—David Shirreff, Barnyards, Inverness-shire.
For the best two Heifers calved after 1st January 1844, seven sovereigns—Lord Lovat.
For the second best ditto, three sovereigns—Alexander Craig, Kirkton, Sutherlandshire.
For the best two Oxen, calved after 1st January 1842, ten sovereigns—Peter Brown, Linkwood, Elgin.
For the second best ditto, five sovereigns—Alexander Craig, Kirkton, Sutherlandshire.
For the best pair of Oxen, calved after 1st January 1843, ten sovereigns—Peter Brown, Linkwood, Elgin.
For the best pair of Oxen, calved after 1st January 1844, seven sovereigns—Alexander Craig, Kirkton, Sutherlandshire.

ABERDEENSHIRE HORNED BREED.

Only 4 animals of this breed were entered in competition,

namely, 2 bulls, 1 cow, and 1 heifer. This breed seems to be going out of existence.

For the best Bull, calved after 1st January 1839, and 1st January 1844, fifteen sovereigns—Alexander Keith, Netherthird, Aberdeenshire.

To the *Breeder* of the best Bull in this section—the Honorary Silver Medal, to said Alexander Keith.

For the best Bull, calved after 1st January 1844, ten sovereigns—Robert Walker, Portleithen Mains, Aberdeenshire.

For the best Cow, calved previous to 1st January 1843, having reared a calf during the season of the show, seven sovereigns—David Shirreff, Barnyards, Inverness-shire.

For the second best ditto. (No entry.)

For the best Heifer, calved after 1st January 1844, five sovereigns—Alexander Keith, Netherthird, Aberdeenshire.

AYRSHIRE BREED.

Of this well-known and widely disseminated breed for the dairy, 31 were entered in competition, namely, 7 bulls, 15 cows, and 9 heifers.

For the best Bull, calved after 1st January 1842, fifteen sovereigns—Archibald Macintyre, Dunalan, Rothesay.

To the *Breeder* of the best Bull in this section, the Honorary Silver Medal—Robert Hunter, St Colmac, county of Bute.

For the best Bull, calved after 1st January 1844, ten sovereigns—Alexander Forbes, Beechwood, Inverness.

For the best Cow in Milk, seven sovereigns—John Inglis Nicol, M.D., Campfield, Inverness.

For the second best ditto, five sovereigns—John and William Chisholm, Viewfield, Inverness.

For the best Heifer, calved after 1st January 1844, five sovereigns—Major Duncan Macpherson, Drummond, Inverness.

For the second best ditto, three sovereigns—John Macewen, Drumrosac, Inverness.

ANY BREED AND CROSSES.

Of these 18 oxen were entered in competition.

For the best pair of fat Oxen of any pure breed, except Short-horn, calved after 1st January 1842, ten sovereigns—Alexander Craig, Kirkton, Sutherlandshire.

For the best two Oxen, calved after 1st January 1842, a cross between a Short-horn Bull and a West Highland Cow, eight sovereigns. (No entry.)

For the best two Oxen, calved after 1st January 1842, a cross between a Short-horned Bull and Ayrshire Cow, eight sovereigns—John Cruickshank, Cloves, Elgin.

For the best two Oxen, calved after 1st January 1842, a cross between a Short-horned Bull and a Pure Cow of any breed except the West Highland or Ayrshire, eight sovereigns. (No entry.)

For the best two Oxen, calved after 1st January 1843, a cross between a Short-horned Bull and West Highland Cow, eight sovereigns—John Cruickshank, Cloves, Elgin.

For the best two Oxen, calved after 1st January 1843, a cross between a Short-horned Bull and Ayrshire Cow, eight sovereigns—Hugh Ross of Cromarty.

For the best two Oxen, calved after 1st January 1843, a cross between a

Short-horned Bull and a Pure Cow of any breed except the West Highland or Ayrshire, eight sovereigns—John Hay Mackenzie of Cromertie.

For the best two Oxen of any cross, calved after 1st January 1842, eight sovereigns—John and James Martin, Aberdeen.

HORSES.

The entire number of horses for agricultural and other purposes entered in competition was 74; namely, 16 stallions, 2 entire colts, 17 brood mares, 15 fillies, 8 geldings, 2 entire saddle-ponies, 9 Highland pony brood mares, and 5 pony geldings. The Judges considered the show of entire horses for agricultural purposes as remarkably good.

FOR AGRICULTURAL PURPOSES.

For the best entire Horse, not under four years, and not exceeding eight and a half years old, bringing evidence of having had produce in the former year, thirty sovereigns—Joseph Skea, Aberdeen.

For the second best ditto, twenty-five sovereigns—Wm. Wilson, Whiteside, Aberdeenshire.

For the third best ditto, twenty sovereigns—Peter Brown, Linkwood, Elgin.

For the best entire Colt, not exceeding three years and six months old, ten sovereigns—Robert Wilson, Brangan, Portsoy, Banffshire.

For the best breeding Mare, having had at least one Foal, and having been at least one year in the possession of the competitor, ten sovereigns—Robert Gentle, Dell, near Inverness.

For the second best ditto, seven sovereigns—Alexander Sutherland, Shempston, Elgin.

For the best three-year-old Filly, seven sovereigns—Robert Gentle, Dell, near Inverness.

For the second best ditto, five sovereigns—Alexander Cruickshank, Pluscardine, Elgin.

For the best two-year-old Filly, five sovereigns—William Hay, Shethin, Aberdeenshire.

For the second best ditto, three sovereigns—Alexander Cruickshank, Pluscardine, Elgin.

For the best four-year-old Draught Gelding, three sovereigns—The Duke of Sutherland.

For the best three-year-old Draught Gelding, three sovereigns—Lord Lovat.

SADDLE PONIES.

For the best Highland entire Pony, not exceeding fourteen hands high, ten sovereigns—The Duke of Sutherland.

For the best Highland breeding Pony Mare of the same height, seven sovereigns—Lord Lovat.

For the best Pony Gelding, not more than four years old, and not exceeding fourteen hands high, five sovereigns—John Cruickshank, Cloves, Elgin.

SHEEP.

There were much fewer Cheviot and Blackfaced sheep, and more Liecesters, entered in competition than might have been expected from this district. The animals were all in excellent condition.

BLACKFACED BREED.

Of this breed 69 animals were entered in competition; namely, 14 tups, 15 ewes, 30 gimmers, and 10 wethers. The tups were considered very superior animals.

For the best two Tups, not exceeding forty-five months old, which shall have served a hirsel of Ewes in 1845, seven sovereigns—A. H. Michelson, Old Faskally, Pitlochry.

For the second best two ditto, five sovereigns—John and Thomas Mackenzie, Achnaclerach, Ross-shire.

For the best pen of five Ewes, not exceeding five years and seven months old, selected from a hirsel of a regular breeding stock, not less than 200, and the pen having reared lambs for the season, seven sovereigns—John and Thomas Mackenzie, Achnaclerach, Ross-shire.

For the second best pen of five ditto, five sovereigns—John and Thomas Mackenzie, Inchbuy, Ross-shire.

For the best pen of five Gimmers, selected from a hirsel of not less than 200, and kept with the others of that age up to 1st June previous to the show, five sovereigns—John and Thomas Mackenzie, Achnaclerach, Ross-shire.

For the best pen of five Wethers, not exceeding five years and seven months old, five sovereigns—John and Thomas Mackenzie, Glengarve, Ross-shire.

For the best pen of five Wethers of any age, fed without restriction, five sovereigns—David Scott, Northfield, near Edinburgh.

CHEVIOT BREED.

Of this breed 150 were entered in competition; namely, 35 tups, 40 ewes, 35 gimmers, and 40 wethers.

For the best two Tups, not exceeding forty-five months old, and which shall have served with a hirsel for a period of not less than one month in 1845, ten sovereigns—Donald Horne of Langwell, Caithness-shire.

For the second best two ditto, seven sovereigns—William Tod, Elphinstone Tower, East Lothian.

For the best two Shearling Tups, seven sovereigns—Alexander Clapperton, Fala Mains, Edinburgh.

For the second best two ditto, five sovereigns—John Murray, Deanshouses, Peebles-shire.

For the best Tup of any age, which has served with a hirsel for not less than a month in 1845, seven sovereigns—William Tod, Elphinstone Tower, East Lothian.

For the best pen of five Ewes, not exceeding five years, and which have reared lambs for the season 1846, seven sovereigns—Alexander Craig, Kirkton, Sutherlandshire.

For the second best pen of five ditto, five sovereigns—Daniel Gilchrist of Ospisdale, Sutherlandshire.

For the best pen of five Ewes, lambed after 31st March 1844, seven sovereigns—Donald Horne of Langwell, Caithness-shire.

For the second best pen of five ditto, five sovereigns—John Murray, Deanshouses, Peeblesshire.

For the best pen of five Gimmers, seven sovereigns—Alexander Craig, Kirkton, Sutherlandshire.

For the second best pen of five ditto, five sovereigns—Alexander Craig, Kirkton, Sutherlandshire.

For the best pen of five four-year-old Wethers, showing most symmetry, fat, and weight, five sovereigns—Alexander Craig, Kirkton, Sutherlandshire.

For the second best pen of five ditto, three sovereigns—Alexander Craig, Kirkton, Sutherlandshire.

For the best pen of five three-year-old Wethers, five sovereigns—Daniel Gilchrist of Ospisdale, Sutherlandshire.

For the best pen of five Wethers of any age, showing most symmetry, fat, and weight, fed without restriction, five sovereigns—Alexander Craig, Kirkton, Sutherlandshire.

For the second best pen of five ditto, three sovereigns—Alexander Craig, Kirkton, Sutherlandshire.

For the best pen of five Ewes, lambed after the 31st March 1844, fed at no time, except on natural pasture, for the last twelve months prior to the show, five sovereigns—Alexander Craig, Kirkton, Sutherlandshire.

For the best pen of five Gimmers, fed at no time, except on natural pasture, for the last twelve months prior to the show, five sovereigns—Alexander Craig, Kirkton, Sutherlandshire.

LEICESTER BREED.

The number exhibited in competition was 71, consisting of 35 tups and 36 ewes.

For the best Tup, not exceeding forty-five months old, seven sovereigns—Hugh Watson, Keillor, Forfarshire.

For the second best ditto, five sovereigns—David Wallace, Balgrummo, Fifeshire.

For the best Shearling Tup, five sovereigns—Thos. Watson, Esperston, Mid-Lothian.

For the second best ditto, three sovereigns—the said Thos. Watson.

For the best pen of three Ewes of any age, five sovereigns—The Duke of Richmond.

For the second best pen of three ditto, three sovereigns—Hugh Fraser, Balloch of Culloden.

For the best pen of three Shearling Ewes, five sovereigns—John Wallace, Banbeath, Fifeshire.

For the second best pen of three ditto, three sovereigns—David Shirreff, Barnyards, Inverness-shire.

SOUTHDOWN BREED.

There were only 11 of this breed entered in competition, consisting of 5 tups and 6 ewes.

For the best Tup, not exceeding four years old, five sovereigns—The Duke of Richmond.

For the best pen of three Ewes, five sovereigns—Hugh Watson, Keillor, Forfarshire.

CROSSES.

There was only one pen of five fat Wethers exhibited in competition in this class, being a cross between the Leicester tup and Cheviot ewe, and the premium of five sovereigns was awarded to John Cruikshanks, Cloves, Elgin.

SWINE.

The limited number of 26 were only shown in competition of this class of stock; namely, 9 boars, 11 sows, and 6 store pigs.

For the best Boar, large breed, four sovereigns—David Robertson, Union Street, Aberdeen.

For the second best ditto, two sovereigns—Sir Kenneth Mackenzie of Gairloch, Bart.

For the best Boar, small breed, four sovereigns—Lord Lovat.

For the second best ditto, two sovereigns—William Sim, jun., Scotsburn, Ross-shire.

For the best Sow, large breed, in pig or milk, four sovereigns—Donald Macintyre, Culchany, Cawdor.

For the second best ditto, two sovereigns—Sir James J. R. Mackenzie of Scatwell, Bart.

For the best Sow, small breed, in pig or milk, four sovereigns—Lord Lovat.

For the second best ditto, two sovereigns—Lord Lovat.

For the best three Store Pigs of the same litter, from four to nine months old, three sovereigns—Daniel Gilchrist of Ospisdale, Sutherlandshire.

For the second best ditto, two sovereigns—Joseph Mackie, Viewfield, Nairn.

POULTRY.

The exhibition entered in competition in this class of stock was considerable; consisting of 10 turkeys, 20 Dorking fowls, 8 other fowls of pure breed, 28 ducks, and 6 geese.

For the best couple of Turkeys of any breed, one sovereign—Daniel Gilchrist of Ospisdale, Sutherlandshire.

For the second best ditto, ten shillings—Sir James J. R. Mackenzie of Scatwell, Bart.

For the best couple of Fowls of the Dorking breed, one sovereign—John Gray, Balnagrate, Cawdor.

For the second best ditto, ten shillings—Daniel Gilchrist of Ospisdale, Sutherlandshire.

For the best couple of any other Fowls of pure breed, one sovereign—William Tod, Elphinstone Tower, Haddingtonshire.

For the second best ditto, ten shillings—John Macewen, Inverness.

For the best couple of Ducks of any breed, one sovereign—Eneas W. Mackintosh of Raigmore.

For the second best ditto, ten shillings—William Tod, Elphinstone Tower, Haddingtonshire.

For the best couple of Geese of any breed, one sovereign—Sinclair Sutherland, Dalmore, Ross-shire.

For the second best ditto, ten shillings—Eneas W. Mackintosh of Raigmore.

EXTRA STOCK.

Of the various animals exhibited in this class, the number amounted to 162—consisting of 62 cattle, 38 horses, 51 sheep and goats, 7 swine, and 4 poultry. There were a few remarkable animals exhibited, such as, a heifer of the West Highland breed, four years old, which only stood about thirty inches in height, and yet was quite symmetrical in form: a Highland pony mare, belonging to Mr Gilchrist of Ospisdale, which is thirty years old, and has her twentieth foal at her foot: and two ewes and two wethers of the old Scotch breed, with horns, chestnut-brown faces and legs, belonging to Mr William Alex. Stables, Cawdor

Castle, Nairn. The same gentleman exhibited a tup, two ewes, and tup-lamb, of the Shetland breed. The goats exhibited were beautiful animals of their kind. There were two fine ducks, of the Black breed, shown by Mr Gilchrist of Ospisdale. The Judges commended for the consideration of the Directors the following animals in this class of extra stock:—

Of the West-Highland Breed—The Cow, aged 3 years and 8 months, the property of David Davidson Manson, Spynie, Elgin; two Oxen, aged 3 years, the property of John Cameron, Corrychoillie, Fort-William, Inverness-shire; the Ox, aged 4 years, the property of John Cruickshank, Marcassie, Elgin; the Ox, aged 3 years and 5 months, the property of the Duke of Sutherland; eighteen Oxen, 4 years old, the property of David D. Manson, Spynie, were strongly commended for their uniformity of size and perfection of symmetry.

Of the Cross Breeds—Two Oxen of a cross with the short-horn breed, aged 3 years and 5 months, the property of John Collie, Ardgay, county of Moray, were commended as a pair of useful two-year-olds for feeding.

Of Horses—A Highland Pony Mare, of the extraordinary age of 30 years and 4 months, with her twentieth foal, the property of Daniel Gilchrist of Ospisdale, county of Sutherland; a pair of very good mouse-coloured Highland Pony Mares, aged respectively 14 and 8 years, mother and daughter—the former being dam to the mare which carried the premium at the Society's Show at Inverness in 1839—the Property of Lord Lovat, Inverness-shire; a pair of good farm Mares, aged 6 years and 4 months, and 5 years and 4 months, respectively, the property of James Cowpar, Fornighty, county of Nairn; a pair of very handsome Ponies, a cross between an Arab horse and Highland pony, aged 5 years, the property of Duncan Davidson of Tulloch, county of Ross; a handsome and useful aged Highland Pony Gelding, the property of Captain Inge, Fasnakyle, Inverness-shire; a thorough-bred grey Entire Horse, the property of David Davidson Manson, Spynie, county of Moray; a neat thorough-bred Colt, aged 3 years and 3 months, the property of Donald Sutherland, Dalmore, county of Ross; a good Cleveland Colt, aged 2 years and 3 months, the property of Eneas Mackintosh, yr. of Mackintosh, Daviot, Inverness-shire; a well-bred Entire Chesnut Horse, aged 6 years, very handsome and particularly gentle, the property of Duncan Davidson of Tulloch.

Of Sheep, the six Tups of the Blackfaced breed, aged 1 year and 4 months, the property of John Cameron, Corrychoillie; and of *Goats* both the lots of two Bucks, the property of John Cameron, Corrychoillie, and of Duncan Mactavish, Strathbeg, Inverness-shire.

Of Swine, the sow of the small breed, aged 1 year and 6 months, the property of Robert Miller, Huntly Street, Inverness.

At three o'clock in the afternoon of Wednesday, the prize animals were walked across the platform in front of the Ladies' Gallery, and the awards of the prizes, with the names of the successful competitors, were announced by Cluny Macpherson; and at four o'clock the doors were thrown open for the departure of the stock.

The total number of stock thus entered in competition were 839, and of extra stock 162, making a grand total of 1001 head in [illegible]40 entries.

PEDIGREES.

The pedigrees of some of the short-horn cattle exhibited may

prove interesting to some of our readers, and they are the following:—

OF BULLS.

Mr Brown's *Bull*, got by the Earl of Durham, dam Lady Anne, by a son of Barclay's Emperor, g d by Invalid, g g d by Satellite (1420), g g g d a Phantassie cow.

Mr Hopper's *Bull*, got by Newton, dam Ganymede, by Uptaker, g d Garland, by Matchem.

Mr Macdonald's *Bull*, got by a bull of Mr Henderson's, Lowick, bred by Mr Smith, Shedlaw, and got by Borderer.

The Duke of Richmond's Bull *(Duke the 3d)*, got by Monsieur (dam by Holkar), dam Eglantine, by Brougham (1746), son of Curry's Duchess, a famed cow, by Wellington (683), g d by a bull of Mr Mason's of Chilton, g g d bred by Mr Weir of Goswick—Monsieur was got by the 2d Duke of Northumberland, and bred by Mr Jobson.

Mr Ross's Bull *(Snowball)*, got by Young Thorp out of Duchess, g d Kilmeny, g g d by Whitelaw, g g g d by Mr Robinson's Albion, g g g g d Europa, by Sirius.

Mr Burnett's Bull Stirk *(North Star)*, got by Albion, dam Princess, by Emperor, g d Queen, by Monarch, g g d Phantassie, by Champion, g g g d Marcia, by Mars (411), g g g g d by Juniper (347), g g g g g d by Alfred (23).

Mr Hay's Bull *(2d Kelly)*, got by Favorite, d Marion, by Anthony (1640), g d Maranda, by Anthony (1640), g g d Merino, by Edgcott (1953), g g g d Matilda, by a son of Mason Merlin.

Mr Hay's Bull Stirk *(Consul)*, got by Lictor, (6128), d Mossrose, by A-la-mode (725), g d by Childers (1824), g g d by Young Wyham (Favorite), g g g d by Quaternion (1351), g g g g d by Rocket (1390), g g g g g d by Waddingworth (688).

Major Macpherson's Bull Stirk *(Mains*—roan), got by Mr Grant Duff of Eden's Sir Thomas Fairfax the 2d (6493), dam Lady Carlisle.

OF COWS.

The Duke of Richmond's Cow *(Almond Flower)*, by Holkar (d), dam Eglantine, by Brougham (1746), son of Curry's Duchess, a famed cow, by Wellington (683), g d by a bull of Mr Mason's, g g d bred by Mr Weir of Goswick.

Mr Ross's Cow *(Arabella)*, got by Mr Ferguson Simpson's old white bull, Sir Young Bull, by Mr Simpson's old white bull, Old Bull, by Young Ladykirk, out of own sister to Romulus. Young Ladykirk was bred by Mr Robertson of Ladykirk out of Pekiah, by Albion, St Ledger by Sir Ellick, Dame by Major (Mr Colling's), g d the American cow, by Yarbro', g g d own sister to Mr R. Colling's Red Rose.

Mr Ross's Cow *(Medusa)*, got by Archibald, dam by Premier (2449), g d by Copland (1871), by a son of Cornet; Premier, by Sir Francis (2625), dam Purity, bred at Ladykirk, by Barmpton (54), g d Charity by Wellington (579), g g d Dairymaid by Sutton, g g g d Ruth by a son of Punch, g g g g d by Dalton Duke.

Mr Young's *two Cows*, got by the Buchan Hero, d Nancy, g d Miss Slate, by Young Ladykirk.

OF HEIFERS.

Mr Hay's Heifer *(Rosemary)*, got by Paragon, dam Spring Flower, by Ganthrop (2059), g d by Narcissus, son of Midas, g g d Ruby by Grazier (1085.)

Mr Macdonald's Heifer *(Barbara)*, got by Mr Inglis's Bachelor, by Hannah, light roan.

Mr Hay's (*2d Barnton*—roan) by Robin Adair, dam Barnton.

Mr Hay's (*2d Marjory*—roan), Favourite, dam Marjory, by Bagdad, g d Merino, by Edgcott (1953), g g d Matilda, by a son of Mason Merlin.

The great dinner was given this day in the large Pavilion erected behind the Academy, at one of the entrances to the show-yard. The Duke of Montrose, President of the Society, occupied the chair, and fulfilled its duties very much to the satisfaction of all present. The day was wound up by a brilliant ball in the evening in the Northern Meeting Rooms.

On Thursday morning a public breakfast was taken in the Northern Meeting Rooms, under the auspices of the Agricultural Chemistry Association, when the topics of conversation were "The composition and use of artificial manures," and "The composition and use of smears for sheep." The first subject was introduced to the notice of the meeting by Professor Johnston, and there was no time to enter on the second.

All the Prize Stock were exhibited this day in the show-yard, for the purpose of being inspected and handled by those who chose to avail themselves of the opportunity of examining them. A sale of stock took place at one o'clock, under the direction of Mr James Chrisp, of Newcastle-upon-Tyne. Very few were disposed of at the sale, but we understand that several purchases were effected by private bargain.

The sums received at all the gates did not exceed £250; and the attendance altogether was perhaps about 4000 persons, independent of those in charge of the stock. The busy operations of the harvest-field, encouraged by the fineness of the weather, and urged to unusual exertion by a scarcity of hands, occasioned by the inordinate demands of the numerous railways now in progress of formation—all these circumstances, no doubt, very strongly induced many farmers to remain at home, who, at a time of leisure, would have gladly partaken of such a meeting.

AGRICULTURAL REPORT.

September 1846.

THE great heat which set in at the date of our last report continued unabated for at least three weeks, and though its intensity diminished after that period, the temperature has continued high ever since under every other circumstance of change. The similarity of this to the summer of 1826, ceased at the abatement of the great heat, as in that very memorable year the sunshine was unclouded for months, and parchedness was the lamentable state of every species of crop. The barley and oats had to be pulled up by the roots, as they could not be reaped with the sickle, the pastures were as brown as if scorched by fire, and the turnips and potatoes exhibited a woful scantiness

of foliage; but the wheat, though deficient of straw, was splendid beyond precedence in quality. Though the temperature this season has maintained itself at a high point, it has been much counteracted in its good effects by great and frequent atmospheric changes. Universally protracted and intense discharges of the electric fluid, were succeeded by deluges of rain such as are seldom experienced in the temperate regions. In the end of June thunder storms of great intensity frequently occurred, followed on one occasion by a rain of thirty-six hours' duration, which measured to the extraordinary depth of 2 9-10 inches. Rivers, in consequence, overflowed their banks, and every low-lying ground was under water for several days. The land was so saturated, that the ordinary operations of the plough were suspended for nearly a month. In the beginning of August a similar deluge occurred, but as by that time the field-labour of the team had been brought to a close, its interference was not so much felt, though the manual operations of hay-making and turnip-singling encountered many vexatious interruptions. In the intervals between the storms, the sky was much clouded, and showers were of usual occurrence, so that the season from the end of June to the middle of August may be characterised as wet and unwholesome. Since that period to the present time, the air has been comparatively clear, dry, and balmy.

The natural effects of these intense, sudden, and violent changes in the atmosphere, may easily be traced on growing crops.

The great heat in June came too suddenly and intensely after the cold and wet weather in spring, during which the spring crops were committed to the ground. The soil, having its dampness quickly evaporated by the intense heat, became hardened on the surface to such a degree as materially to retard the growth of all the crops. It was early observable that the oats would soon run to seed while the plant was only a few inches above the ground, and that the earliest sown barley would either not come up at all, or be stinted in the same manner as the oats. Both these crops shot out in straw after the rain began to fall; but it was obvious, that both had received such a check from the drought, as would cause them to produce a light crop, even under the most favourable circumstances of weather to the autumn. The results really are, that oats are light in the sheaf, as if they had been prematurely brought to maturity, and barley has all along been thin on the ground, and cannot therefore yield abundantly. The wheat, too, will not yield according to appearance. We said that many of its leaves became brown in the spring; and in consequence of this weakness in the plant at so early a stage of its growth, with

the sudden change of the ground from a soft state by wetness, to one of hardness by arid drought, together with the damp state of the air when the plant was in bloom,—all these untoward circumstances combined, cannot fail to reduce the productiveness of the crop, though the grain will no doubt prove good, if not of fine quality. The greatest weight we have seen quoted in Edinburgh, is 62¼ lbs. per bushel. The first great storm in June, occurring when the straw was yet short, had not the effect of laying any of the crops; but the storm in August, which was moreover accompanied with hail, beat down the straw, and in parts, where the storm was most violent, nearly levelled it with the ground. The fine weather for the last month has enabled the harvest operations to be conducted without interruption, except when the dew was heavy in the morning; and though the air has been in a very calm state, which was rather unfavourable to the preparation of the stooks for the stack-yard, yet the dry air, the bright sun, and the warm temperature combined, rendered the corn fit for carrying home sooner than might have been expected in such a calm.

The nature of the temperature this season has had a curious effect upon the crops. We have already remarked that the temperature has continued at a high range; but what was remarkable in regard to it in this country, was its uniformity by night and day, not but that the day was always some degrees warmer than the night, still the warmth of the night was so great, and unusually so, that plants of all kinds run their course in an unusually short time. So remarkable was this tendency to maturity in the cultivated crops, that had it not been for the check occasioned in their growth by the cloudy sky and frequent showers of July, they would actually have become ready for the sickle in that month. In the south of England harvest began in July, and this result was solely owing to the dry weather experienced in that part of the country, when Scotland and the northern parts of England were visited by daily showers and even rainy days in that month, for the crops of this country were as far advanced in June as they were in the south of England. Warm nights and days are no unusual accompaniments in summer in England, and in effect produce the results of two warm days in one; but in Scotland such a combination is rare, and hence the harvests are always some weeks later than in the more favoured clime of her neighbour.

A want of labourers was very much felt this summer—the railways having engaged the surplus hands of the country, and the natural consequence of such a scarcity was great advance of wages. What with the increased cost of harvest, and the advanced wages of ploughmen, throughout the year, the expenses

of the farmer will be very much increased, while his income to meet them will be diminished. There were as much as 20s., with victuals, given for reapers for one week at Coldstream; and the ordinary wages averaged as high as from 16s. to 18s. a-week, with food. The improved weather by the middle of August, together with the usual effect of bright sunshine after rain in ripening corn, made all the crop fit for the sickle at one time throughout the country; and fortunate it was that the air continued calm while the crop stood fully ripe, and there was a want of hands to cut it down, otherwise the consequences of shaking by a high wind would have been calamitous.

The pastures proved good through the season; and yet in the early part of summer they had the appearance, from a distance, of having been burnt up. The phenomenon may be explained in this way, though we believe few persons would think of so explaining it.

We noticed in the last report that pastures were good in consequence of not having been touched by stock until late in the season; because winter food was so abundant as to detain the stock longer in the house than usual, and being thus long detained, many animals which were wont at their age to be sent to pasture, were sold off fat from the court-yard. The immediate consequence of this forbearance to the pasture, was to permit the perennial rye-grass to become rank before the stock were put upon it; and as that plant soon runs to seed, and the weather was peculiarly favourable for that development early in the season, it was too far advanced to be relished by stock, and on being thus neglected and uncropped, the stems produced seed, and became withered, and the withered stems seemed to cover the whole ground from a distance.

The hay was by no means a heavy crop, the clover having been destroyed early in spring. The wet weather ensuing, caused the grass in many instances to stand too long, and after it was cut, there was great difficulty of obtaining as much fair weather as to allow it to be taken off the ground and ricked. These unfavourable circumstances had a powerful influence in deteriorating its quality.

The turnip crop at present is in a very unsatisfactory state, compared with what it was this time last year. Owing to the excessive drought, a large proportion of the early sown Swedes did not vegetate at all; and where the blanks were sown with white turnips, it was not to be expected that such an expedient would render the crop valuable; at all events, it could never redeem the loss of the Swedes. The later sown Swedes will be good, as the rain came in time to soften the ground, and cherish the embryo plant; and perhaps the yellows may be in as favourable a state as

the late Swedes. But the white turnips received very severe treatment. After the early ones were sown, the deluge of rain following the first storm so soaked the land as to prevent all work upon it for nearly four weeks; and by the time it was in a state to be worked, the season was too far advanced for sowing turnips, and yet what else could be done than to get out of the predicament as quickly as possible? The use of guano and bone dust, and some of the saline manures, enables the farmer to proceed with turnip-sowing at much greater speed than he can with common farm-yard manure, and in this way speed makes up for loss of time. The singling of the early sown turnips, after the land had been battered with the heavy rain, proceeded slowly and unsatisfactorily; and, to make the matter worse, there was a scarcity of hands, by reason of the simultaneous demand for them over the country. One should have supposed that the mild nights and days, and sufficient moisture, would have been favourable circumstances for the further progress of the turnip crop, and yet it is not in a sound state. The plants want vigour, there being an evident tendency to mildew, and there is a peculiarly offensive odour exhaling from them; and, in fact, many of the bulbs are rotting and rotten, while the leaves indicate no such unhealthy state. No cause but that of too rapid vegetation seems capable of explaining the putrescent state of the bulb, and yet much greater rapidity of growth in other seasons has not produced a similar result. We only speak from report, and know not the extent of the evil; but that there are grounds for the utmost alarm there is unfortunately no doubt. Great as the calamity of the failure of the potato crop certainly is, a disease which would at one fell swoop destroy the turnip crop, would be an evil of much greater magnitude. The potato, it is true, is the food of man, while the turnip is only raised for the use of animals; but man can subsist upon many other articles of food than the potato, and possesses, besides, the means of procuring them from every quarter of the globe; while the domesticated animal is wholly dependent on the vegetables growing within its reach, and cannot return such a profit as would remunerate his owner for the trouble and expense of transporting its food from distant countries; and as the domesticated animal which subsists upon the turnip is a ruminant, and therefore requires succulent food in winter as well as summer to fill its paunch, it would be impossible to find any where such a quantity of food in that state as would satisfy a winter's consumption by all the sheep and cattle of this country; and, if found, it would be as impossible to import it.

We now approach that mystery of mysteries—the potato fail- [illegible] called, the potato disease, and

potato-murrain. Last year the potato crop was found in many places to exhibit symptoms of decay shortly after the beginning of September, when a great fall of rain and hail, accompanied by high wind, and succeeded by sharp frosty mornings, beat down and blackened the potato tops; and, on observing the general character of the season to be wet and cold, we ascribed the proximate cause of the failure to the combined effects of these elements, and expressed a conviction, that until such another combination of influences occurred, we had no expectation of again meeting this disease. The state of the crop of this year, however, completely falsifies that theory; for it is in a much worse state, and more generally diffused, than it was last year, when it was cold, than in this very mild, warm summer. Still, this summer has been wet, the ground has been more often and even more thoroughly soaked than in last year, and the failure was universally observed to make its appearance immediately after the great thunder-storm and deluge of rain in the beginning of August. Wetness, therefore, may still be supposed to have had some influence in promoting the disease, and its recurrence in a dry season can alone demonstrate the fallacy of the "aqueous theory;" though the low temperature must now be admitted to have had nothing to do in promoting it. We cannot say what the actual state of the potato crop is, very little of it as yet having been taken up, though the apprehension is, that it is completely destroyed; and even supposing that every potato in the ground is in a sound state, the crop must be very small, inasmuch as the disease overtook it at an early period of its growth. The recurrence of the disease this season excited much surprise, for the potato plant has not shown so much vigour, and exhibited so beautiful and healthy a display of blossom for many years. Though the fate of the field varieties is such, it is certain that many of those of the garden are still fit for the table.

Whatever may be the nature of the affection which has overtaken the potato, it does not seem to be confined this season to that crop. The beans have had their leaves blackened, and their stems shrivelled by apparently the same cause; and the rottenness in the turnip may safely be ascribed to the same influence. The products of the flower-garden have not escaped the affection, for the leaves of the peony seem to us to have suffered from the same source. Even forest trees are affected, as the appearance of the balsam poplar clearly indicates. And wild plants have been observed to suffer in a similar manner, as is instanced in the case of the common fern. So far as we can discern, the mysterious cause of this universal affection, is very much "like the pestilence that walketh in darkness, and that wasteth at noonday."

Two of the three great Trysts at Falkirk have been held in the course of the last quarter. There were not so many animals on the fair-ground as used to be, owing, it seems, to most of the best lots being bought up by the English dealers on their way to the market. This is a good symptom for the future demand, and those who usually attend the October Tryst may therefore look forward to good prices. The stock seemed all in good condition.

In consequence of the ascertained failure of the potato crop, the corn trade has been, of late, excited to an universal degree, and the averages have risen considerably, though the duty still continues at the highest rate of 10s. a quarter for wheat. Should our grain crops prove deficient, of which there is some apprehension, along with that of the potato, it is questionable that our wants will be supplied by our European neighbours. France, Holland, and Belgium, have all deficient crops; and it is a curious anomaly to observe wheat exporting at this moment to those countries from this. Both the Baltic and Mediterranean will be required to supply the deficiency of those countries; and as the staple grain of Poland—namely, rye—has failed, the wants of the Polish people will prevent them exporting the usual quantities of wheat. With such prospects before us, there is no likelihood of the price of wheat falling below present prices, especially when our supplies must be obtained from the very distant ports of America.

FOREIGN MARKETS, per Imperial Quarter, free on board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1846.							
June.	Danzig.	42/ to 48/	20/ to 25/	15/6 to 18/6	30/ to 34/6	28/ to 33/	28/6 to 33/
July.	......	43/ . 48/6	19/ . 24/	14/ . 18/	28/6 . 32/9	27/6 . 32/	27/6 . 32/
Aug.	......	40/6 . 45/6	22/ . 27/	16/ . 20/	31/6 . 35/6	29/6 . 33/6	29/6 . 34/
June.	Hamburg.	43/6 . 48/	20/ . 23/6	16/ . 22/6	28/ . 31/6	29/6 . 32/6	30/ . 34/6
July.	......	40/9 . 45/6	20/6 . 24/	15/ . 20/6	27/6 . 30/6	26/6 . 30/6	26/6 . 32/
Aug.	......	42/ . 48/	26/6 . 29/6	14/6 . 18/6	29/ . 32/6	27/ . 33/6	28/ . 34/9
June.	Bremen.	42/ . 50/	20/ . 26/6	18/6 . 23/6	36/6 . 40/	27/6 . 31/6	28/6 . 32/6
July.	......	40/ . 47/6	19/6 . 25/6	16/6 . 20/6	34/6 . 38/0	26/6 . 30/6	27/6 . 32/
Aug.	......	42/ . 47/6	22/ . 27/6	18/6 . 24/	32/ . 36/0	28/6 . 33/	29/6 . 34/6
June.	Konigsberg.	42/6 . 49/	20/ . 25/6	18/ . 22/	25/ . 28/6	28/ . 30/6	29/ . 32/6
July.	......	40/6 . 46/	18/6 . 22/6	16/ . 19/6	24/ . 28/	27/6 . 30/0	28/ . 30/6
Aug.	......	43/ . 50/	22/ . 28/	18/6 . 22/6	25/ . 31/6	27/ . 32/	30/ . 33/6

Freight from the Baltic from 3/ to 4/3; and from 7/ to 8/6 from Trieste, Alexandria, &c., to Great Britain.

TABLE OF PRICES, &c.

verage Prices of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets :—

LONDON.

Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Rye. s.	d.	Pease. s.	d.	Beans. s.	d.
55	5	28	1	23	9	33	5	35	7	37	2
55	2	28	2	23	11	33	9	38	7	35	0
54	1	27	5	23	5	34	2	34	6	33	11
55	3	28	7	23	8	33	0	38	3	34	6
60	3	28	4	23	9	34	10	40	7	37	9
57	6	28	9	24	6	34	5	36	7	36	5
56	1	27	5	22	2	34	0	38	11	37	11
52	10	28	2	23	6	33	6	37	6	39	4
50	4	27	11	23	4	33	2	39	8	38	11
49	2	25	7	24	1	32	0	37	3	42	2
50	2	27	0	23	3	32	2	38	4	38	11
49	8	27	2	23	1	34	0	39	1	39	3
54	3	29	8	22	0	33	2	42	10	39	1

LIVERPOOL.

Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Rye. s.	d.	Pease. s.	d.	Beans. s.	d.
51	5	29	0	27	5	33	2	37	3	38	8
48	5	27	6	25	0	32	10	...	...	36	9
50	0	28	2	25	3	32	6	42	8	42	0
49	11	28	4	23	11	33	8	35	6	39	2
49	7	25	2	24	6	33	10	42	6	43	7
49	3	25	3	24	7	34	2	42	2	41	3
47	7	25	9	25	2	34	6	42	0	40	6
47	6	25	7	24	5	33	8	39	6	41	10
45	11	25	6	25	0	34	2	40	4	42	4
45	0	25	4	25	1	34	0	38	8	40	9
44	1	25	0	23	5	33	8	39	6	41	10
43	4	25	8	23	10	34	0	37	4	41	2
49	3	26	9	25	4	33	4	40	1	44	10

EDINBURGH.

Date.	Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Pease. s.	d.	Beans. s.	d.
1846.										
June 3.	54	2	32	3	32	8	51	0	51	10
10.	54	1	32	11	32	9	52	0	52	11
17.	55	6	33	0	32	8	44	6	45	0
24.	56	6	33	10	32	9	45	0	45	4
July 1.	52	0	33	0	30	10	40	0	40	7
8.	51	10	31	11	30	0	43	0	43	7
15.	51	2	31	0	29	5	42	0	42	4
22.	48	6	28	9	28	1	43	0	43	6
29.	50	7	29	9	29	2	40	2	40	8
Aug. 5.	49	0	31	5	29	10	43	6	44	2
12.	48	2	30	7	28	6	43	2	43	8
19.	49	11	32	7	29	6	46	2	46	8
26.	54	9	31	6	28	2	46	0	46	6

DUBLIN.

Date.	Wheat, per bar. 20 st. s.	d.	Barley, per bar. 18 st. s.	d.	Bear, per bar. 17 st. s.	d.	Oats, per bar. 14 st. s.	d.	Flour. per bar. 9 st. s.	d.
1846.										
June 5.	31	0	14	1	13	6	16	0	18	0
12.	31	6	14	4	12	9	15	9	18	2
19.	30	3	14	3	12	2	15	3	17	6
26.	30	2	13	11	11	8	14	8	17	2
July 3.	28	3	14	7	11	6	14	2	17	6
10.	28	11	14	9	11	4	13	11	17	3
17.	28	7	14	10	10	10	14	4	17	2
24.	28	10	14	6	10	5	14	2	17	0
31.	28	0	14	8	10	10	14	5	17	3
Aug. 7.	26	4	14	11	10	7	14	3	17	0
14.	27	0	14	9	10	11	13	10	16	10
21.	30	0	14	6	12	4	15	4	17	4
28.	28	5	14	10	13	2	14	5	17	6

E showing the Weekly Average Price of GRAIN, made up in terms of 7th and 8th Geo. c. 58, and 5th Vict., c. 14, and the Aggregate Averages which regulate the Duties pay- on FOREIGN CORN : the Duties payable thereon, from June to September 1846.

Wheat. Weekly Average. s.	d.	Aggreg. Average. s.	d.	Duty. s.	d.	Barley. Weekly Average. s.	d.	Aggreg. Average. s.	d.	Duty. s.	d.	Oats. Weekly Average. s.	d.	Aggreg. Average. s.	d.	Duty. s.	d.
3	2	55	3	17	0	27	8	28	11	9	0	23	4	23	8	5	0
2	0	54	7	18	0	27	1	28	6	9	0	23	7	23	8	5	0
1	5	53	3	18	0	27	2	28	1	9	0	23	3	23	7	5	0
2	2	52	10	5	0	27	4	27	9	4	0	23	6	23	6	1	6
2	10	52	8	5	0	27	5	27	6	4	0	23	8	23	4	1	6
2	8	52	3	5	0	27	7	27	5	4	0	24	3	23	7	1	6
0	10	51	11	6	0	27	10	27	6	4	0	23	0	23	8	1	6
0	11	51	7	6	0	27	2	27	5	4	0	23	5	23	6	1	6
7	6	50	11	7	0	26	11	27	6	4	0	23	6	23	7	1	6
5	2	49	9	8	0	26	9	27	4	4	0	24	0	23	8	1	6
5	1	48	6	9	0	27	3	27	3	4	0	23	3	23	7	1	6
5	11	47	5	10	0	27	5	27	4	4	0	23	2	23	5	1	6
7	10	46	11	10	0	29	1	27	5	4	0	23	0	23	6	1	6

Rye. Weekly Average. s.	d.	Aggreg. Average. s.	d.	Duty. s.	d.	Pease. Weekly Average. s.	d.	Aggreg. Average. s.	d.	Duty. s.	d.	Beans. Weekly Average. s.	d.	Aggreg. Average. s.	d.	Duty. s.	d.
32	10	33	2	9	6	34	10	34	6	8	6	35	10	35	8	7	6
32	4	33	3	9	6	34	9	34	8	8	6	35	8	35	10	7	6
33	4	33	1	9	6	32	6	34	3	8	6	36	4	35	11	7	6
32	7	33	0	2	0	35	0	43	4	2	0	37	6	36	2	2	0
33	3	32	9	4	0	35	5	34	6	4	0	38	5	36	7	4	0
33	11	33	1	4	0	35	3	34	7	4	0	37	11	36	11	4	0
36	5	33	8	4	0	36	4	34	10	4	0	38	4	37	4	4	0
29	9	33	2	4	0	36	10	35	3	4	0	38	9	37	11	4	0
28	2	32	4	4	0	35	11	35	9	4	0	39	3	38	4	4	0
29	8	31	10	4	0	35	3	35	10	4	0	39	8	39	9	4	0
30	7	31	5	4	0	36	0	35	11	4	0	39	6	38	11	4	0
30	10	30	11	4	0	36	9	36	2	4	0	39	9	39	3	4	0
31	10	30	1	4	0	38	6	36	6	4	0	39	10	39	5	4	0

PRICES *of English and Scotch* WOOL.

ENGLISH, per 14 lb.	
Merino,	14s. 0d. to 20s. 0d.
.... in grease,	12s. 0d. ... 16s. 6d.
South down,	14s. 0d. ... 20s. 0d.
Half-bred,	12s. 0d. ... 16s. 6d.
Leicester Hogg,	13s. 6d. ... 19s. 6d.
.... Ewe and Hogg,	11s. 6d. ... 16s. 6d.
Locks,	6s. 6d. ... 9s. 0d.
Moor,	6s. 0d. ... 8s. 0d.

SCOTCH, per 14 lb.	
Leicester Hogg,	18s. 0d. to 20s. 0d.
.... Ewe and Hogg,	11s. 0d. ... 15s. 0d.
Cheviot, white,	10s. 0d. ... 14s. 0d.
.... Laid, washed,	7s. 0d. ... 10s. 0d.
.... unwashed,	6s. 0d. ... 9s. 0d.
Moor, white,	5s. 0d. ... 7s. 0d.
...... Laid, washed,	4s. 0d. ... 6s. 3d.
.... unwashed.	3s. 0d. ... 5s. 0d.

PRICES *of* BUTCHER MEAT.

Date, 1846.	LONDON. Per stone of 14 lb.		LIVERPOOL. Per stone of 14 lb.		MORPETH. Per stone of 14 lb.		EDINBURGH. Per stone of 14 lb.		GLASGOW. Per stone of 14 lb.	
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
June	7/3 to 7/9	7/3 to 8/	6/9 to 7/9	6/6 to 7/6	6/6 to 7/6	6/ to 7/6	6/3 to 7/6	6/6 to 7/6	6/6 to 7/9	6/6 to 7/9
July	7/ . 7/6	7/ . 7/6	6/6 . 7/6	6/3 . 7/6	6/ . 7/3	6/ . 7/3	6/ . 7/3	6/ . 7/3	6/3 . 7/6	6/3 . 7/6
August	7/6 . 8/	7/6 . 8/	6/9 . 7/9	6/6 . 7/9	6/6 . 7/6	6/3 . 7/9	6/ . 7/3	5/9 . 7/3	6/6 . 7/9	6/6 . 7/9

THE REVENUE.

***ABSTRACT** of the Nett Produce of the Revenue of Great Britain, in the Quarters and Years ended on the 5th of July* 1485, *and 5th of July* 1846—*showing the Increase and Decrease on each head thereof.*

	Quarters ending July 5.		Increase.	Decrease.	Years ending July 5.		Increase.	Decrease.
	1845.	1846.			1845.	1846.		
Customs	£4,499,548	£4,523,391	£ 23,843	....	£19,807,044	£17,688,461	....	£2,118,5[illegible]
Excise	2,965,684	3,104,711	139,027	....	12,074,999	12,025,112	....	49,[illegible]
Stamps	1,837,076	1,730,495	....	£106,581	6,846,883	6,988,940	£ 142,057	....
Taxes	2,000,567	2,006,427	5,860	....	4,228,441	4,229,899	1,458	....
Post-Office....	155,000	181,000	26,000	....	679,000	794,000	115,000	....
Miscellaneous	43,652	458,001	414,349	....	783,819	1,484,096	700,277	....
Property Tax	909,991	1,009,162	99,171	....	5,261,954	5,183,912	....	78,04[illegible]
			708,250	106,581			958,792	2,246,51[illegible]
	Ded. decrease on Qr.		106,581	....	Deduct increase on Yr.		....	958,79[illegible]
	Increase on the Qr.		601,669	....	Decrease on the Year.		....	1,2[illegible]7,72[illegible]

SOME FRESH HINTS ON THE NATURE OF THE SALMON, AND ON CONDUCTING THE SALMON FISHERIES OF THE TWEED.

By Mr John Younger, St Boswell's, Roxburghshire.

Though our king of fish, the Salmon, be properly a native of the cooler parts of the temperate latitudes, yet those bred in our Scottish rivers never seem to migrate further north, but keep verging on the shoals of our coasts, being no doubt instinctively aware of their proper locality.

That the different kinds of salmon associate more particularly with their own family circles, seems clear, from their entering our rivers in shoals of the same class; and that they sojourn at no great distance in the sea, appears also evident from their readiness to enter the rivers on our east and west coasts annually, as nearly at the same time as the casual floodings of those rivers will allow. And, further, their appearance in them sooner or later in any season, depends on the period of rains and consequent floods.

Early frost and rough north winds have, in some seasons, been understood to drive salmon earlier into the rivers. Hence, in milder winters, when they happen to be scarce or late, our fishers have supposed that they had gone to the Norwegian rivers; but this seems to be a mistake, since the proofs have been adduced that fish are as local as sheep, and tenaciously adhere to the river streams and sea fields in which they have been bred and nurtured.

Above forty years ago, our old fishers were accustomed to point out an occasional salmon as "a north-country fish." There certainly was a visible difference in the spots, figure, and appearance, from "our ain fish," as they were called, though I have not seen any of these northerns distinguished for many years back, and but transiently, in those days, in the case of a stray individual.

It seems clear that the salmon in the sea do not form promiscuous shoals, but keep together in friendly groups, or are ready to fall into such, so as to take their own native streams on every return to fresh water, for the purpose of pleasure or propagation, but, if hindered, will, of course, take to the next nearest stream. And why should we seek to divest fish of those local feelings, so strongly instinctive in all land animals, from men to magpies? Though they may live in other soil or climate, yet they naturally incline to their own.

But for netting interruptions at our river's mouth, we should have new fish, of one description or another, from the sea every slight flood throughout the year; as, all summer, there are clean salmon in their silver beauty, pointing on our coast, seek-

ng the freshes, when up they go the river in any day when not prevented. We have little chance of this, however, except from a sudden summer flood that lays some of the Tweedmouth nettings and let a few pass by. These, if left alive, remain in the fresh to spawn the earliest, succeeded by later ones. But, what from drought and nettings, and other such causes of prevention, we can calculate on no free run of fish till the late autumnal floods, when the first that arrive in any great quantity is a mixture of the earlier grilse, and the common clear-scaled salmon of various size, according to age, but all in tolerably good condition, as fish generally are on leaving the sea, even when pretty full of spawn.

Except the *bull trout,* there is no variation remarkable until the last shoal arrives with an early winter flood. Those of the *grey school* are the heaviest, and the last running class of fish. Their lateness indicates they are the last to spawn, and of course to seek after the proper situation for that purpose, and which they find from recollection or intuition. Though the latest in seeking the rivers, they are by no means pointed as to time, but come sooner or later in the season, agreeably to particular states of weather and water. Under even the most favourable circumstances, they seldom, if ever, enter the river until some time after the close-time has commenced in November, and more usually they do not arrive till December and January. Their arrival in close-time may in a great measure account for their large size; escaping in their youth the nettings within tideway, unlike most of our other summer fish, and thus live to attain size with age. Hence, if not our finest, they are at least our heaviest and most valuable class of fish, weighing from twelve to twenty-five pounds—the younger ones of the class not being regarded as remarkable.

I do not suppose that their lateness of arrival indicates in the slightest degree their being longer in one year than in another in spawning, as this rather depends upon the facilities of prosecuting their journey, in the favourable coincidences of fresh water, winds, and tides; for, when later in coming, they invariably seem to be further advanced in spawn. They, of course, do not spawn early, perhaps hardly ever previous to February, but in March and April, and some as late as May. Hence, when they get early up the river, they are grand sport for the rod angler, strong and fresh, like a grass-fed heifer a little gone in calf. It has a spirit-stirring effect to feel their tug, and see their first grand sally and plunge abroad in the river at the end of a tight gut line.

At first sight, it might appear as if the *grey school* were the [illegible] with [illegible] summer salmon, and the difference in

their appearance were occasioned by having attained a more mature age, or from coming into the fresh at a later season; but such seems not to be the cause, since the distinction of appearance and habits together, though decided, is not so particularly marked as to be clearly definable. They partake of all the characteristics of the true-bred salmon, however—bred in our rivers, going out to sea, at large, northwards, and returning again for the purpose of annual propagation; and, being the latest class in spawning, they may properly be called our *winter fish.*

I would, upon the whole, however, consider our early summer salmon our finest fish, as far as beauty of colour, scale, and figure are concerned, with corresponding delicacy of flavour. In comparison, they bring to mind a fine white autumn turnip, which is more delicious, far, than the stronger-tasted winter Swedes and yellows.

But the fish most notable, and now with us so common, is the bull trout, (*Salmo eriox,*) a perfect cannibal amongst the salmon species, and seems destined likely to root out and supersede the salmon in our rivers.

On my first coming to the Tweed here in 1802, the old fishers spoke of the bull trout as a monster of very casual appearance, under the name of *square tail* or *round tail,* meeting with one or two only in a whole season; and they supposed it a hybrid between the salmon and large common river trout. Old water-bailiff Balmour primmed his lips and laughed at my boyish conceit, when I presumed that it was a distinct though scarce species. It has multiplied gradually since, however, until now it is by far the most plentiful of all the migratory salmon in our river, and is found of all sizes, from the grilse state, when it is named the sea trout, to sometimes to twenty-five pound weight. It is the first to come up the river in the early autumn floods, by which all the smaller, and particularly the more easy running streams and tributaries, such as the *Till, Kail,* and *Tiviot,* are filled with it, with often only a slight admixture of the real salmon and grilse.

Bull trouts do not rise to the salmon-fly so readily as the salmon on their first coming from the sea; but are voracious in winter and spring, after having spawned and got into the *kelt* state, and are then the worst of all our fish for eating. They are never indeed the most excellent eating, even in their clean state, being as coarse in this respect as in their appearance, when compared with the fine form and delicious richness of the salmon. More pale and stringy in their flesh, their roe also has not the fine rich redness of that of the salmon, being of a dull yellow colour, and slabby; and almost useless as a trout bait. In a zoological point of view they seem as if a prior and less finished

production of nature than the salmon; and as in a world of continued creation, such as this, their fossil remains, when hereafter found in the *chalk*, may be mistaken for those of the much superior salmon, which they so closely resemble.

But the worst property of this species is, that they devour the salmon spawn so greedily, that it is most likely, ere forty more years elapse, they will have exterminated the breed entirely. Let any one keep a good look-out from an eminence over a spawn-bed, and observe a fine pair of salmon in the act of spawning, and he will, as certainly, also see, a little below them, a fish, probably the largest of the three, lying at ease in the hollow trough, catching the roe as it falls away from the female, having only to open its mouth to receive thus an abundant supply of food; and a continued observation will convince him, that not a third or a fifth part of the roe falls into its destined position. He may also observe a few smaller fishes, it may be of its own kind, or like trouts of various sizes, keeping at a cautious distance behind this *black-mail* marauder, but all as busy and active as he in catching the stray roes, as they float down or sink upon the gravel. In this group, none are more busy and active than Mr Shaw's little *par*, in picking up and gulping the roe in the wake of the spawn-bed, where Mr Shaw supposes this tiny insignificant fish is placed for the purpose of impregnating the said roe—an idea as extravagant as the wildest vagaries of a romance. However correct in his main opinion, derived from a class of excellent experiments, that the par is the young of the salmon, or other red sea fish, of the first season, still the impregnation of the roe of a fifteen pound *baggit* salmon, by a two ounce par of her last year's spawn, is too great a stretch for a vulgar fisherman's comprehension or credulity; however many "learned Thebans" may believe it.

May we not, with more probability of truth in nature and reason, imagine, that the roe of the baggit salmon which Mr Shaw spawned by compression, and at the same time brought in contact with the milt of the small male par, and thereby supposed to have impregnated the female's spawn as emitted—is it not as probable, that at least a quantity of the spawn would have produced the young, as well without, as with contact with the puny par? I am of opinion that it would; believing that the female salmon had already been impregnated by previous connexion with a *mature* male; though the period and manner of such connexion have not been perceived, and are, therefore, unknown to us.

In short, after all that has hitherto been surmised on the subject, I have a notion that whatever appearances the actual spawning of fish may present to our view, the mixture of the

milky milt alongst with the full round red eggs as they fall into the gravel bed together, does not warrant the conclusion that this is the only fecundating operation in the case, though the milt may be of supplementary use in making the roe adhere together, and sink suddenly in the stream as it is observed to do, as well as for the promotion or preservation of heat, or other protective quality, to the emitted eggs, consigned as they are to a cold and uncertain situation. I would rather presume that the great act of causing fruitfulness is a matter of previous intent between full ripe individuals, and, being performed in the dark medium of moving waters, has yet escaped human investigation. In Mr Shaw's particular case of experiment, the fecundity of the roe might be preserved without the aid of milt as an investing unguent, by the temperature of the preserved water in which the experiment was made being some degrees higher than that of the river; and the roe of full-grown females could be nothing benefited, one should think, by the milt of a creature not in its whole body a twentieth part the size of the female's bellyful of spawn, and of age so premature as not to warrant the supposition of any such a result in nature. The female, it is understood, can emit her spawn without assistance of the male, and we do not positively know whether or not it is impregnated before emission, and whether, in favourable situations, it may not be prolific, without the aid of the milt.

The roe, when emitted, or just previous to its being taken out of the belly, appears entire, with all its requisite parts—the necessary requirements of vivification apparently already supplied, inclosed, finished, and sealed up in its tough film, like the egg of an insect, and differing from that of a bird only in its outward coating of the lime shell. I should like if Mr Shaw would favour us with another experiment of spawning another female salmon in his preserve, at the same temperature as formerly, but without the assistance of a little par. The result of such an experiment might go far to settle the question as to the state of the roe in the female salmon, while the precise means and manner of fecundation would be a subject to be observed and filled up at leisure.

Meantime it may not be too great a stretch of fancy to suppose, that the eagerness with which fish come together on the spawn bed, may be caused by stronger excitement for personal contact than we have yet been able to observe; because, in spawning, the male and female are seen to turn on their sides in the manner commonly called *casting*, and thus come in contact in sudden jerks, and with close compressure of their bellies, continuing these motions repeatedly, and at intervals for days and nights, throwing off together their large bellies-full of spawn and milt. May we not further suppose, that, as salmon and other spawning

fish are naturally long-lived creatures, they go long with spawn, about twelve months; that on minute dissection of a lately spawned female, the germs of the next season's eggs may be detected in the ovary; and that, therefore, in the very act of spawning a present progeny, the parents may be committing an instant act of impregnation for a future generation?

It might be stated here in objection, that if this is the natural course of propagation with fishes, and the impregnation only takes place at this interesting season, how the female becomes impregnated for the first time?

In answer to this, we may ask the same question in regard to the tame rabbit, the female of which is generally watched and waited on, in eager impatience, by the male, till the instant after the litter appears impregnation is effected. In the case of the rabbit, then, when is the first impregnation effected? Just in a similar manner, I suppose, the fish are impregnated; though, from the peculiar construction of the animal parts, and the mystification by the watery medium, the embrace of a fish is not brought so convincingly under our eye as in that of the land animal.

It may also be advanced, that toads and frogs are understood to spawn in the manner of fish, the male impregnating the eggs after being emitted from the female, and these creatures being of the reptile class—a slight step higher in the scale of animated creation than fish—we need seek no further proof, in analogy, for a reason to rest our present subject upon so long an acknowledged basis. Still, on observing an effect, we are led naturally into speculations in search of a cause; as was the case of the discovery of the new planet by Leverrier, perhaps the greatest modern triumph of inductive science.

The long-believed opinion of the manner of frog-propagation may by-and-by be found a vulgar error, under a more inquisitive philosophy. I presume that the male frog, or toad, takes his place, settled and fixed, on the female's back, in the pool of water, for days previous to her spawning, for the special purpose of securing a preference to his occupation of that position, and of being ready for a new impregnation the instant after the female has thrown off her string of present eggs. The male's presence in that position is likely also necessary for the facilitation of the present birth; which, though not his chief aim, yet proves the observation of our great didactic poet, when speaking of the superior excellence of God's works in nature to the works of man in art, where—

> "In human works, though labour'd on with pain,
> A thousand movements scarce one purpose gain;
> In God's, one single can its end produce,
> Yet serves to second too some other use."

It may at least be presumed, that the milt of the male fish is not the real sperm or seed, but only an abundant provision of nature for the purpose of fostering and protecting that more primary principle; and I am led to believe, upon the whole, that spawn-fish go into sexual connexion in the usual manner of land animals, water flies, and most other of the oviparous tribes.

* * * * *

If we have no proper idea of the purpose of the large pike or *kip*, like a finger, growing in projection from the under-snout of the male salmon, just previous to the spawning season, and fitting into a hole of proper dimension on the upper chap of the snout, (from which conformation at that season the male derives the name of *kipper*, as does the female that of *baggit*, from the full state of belly,) and this pike falling so suddenly and entirely off, and its case also filling up immediately after spawning; as well as the dark red colour of the whole body of the male changing to a pale silvery grey, till one cannot distinguish male from female, the cause of so remarkable changes being unknown to us, need we wonder that the still more complex construction of the genitals, and of the manner of their use, should to this day be unascertained? One is led to doubt whether the minute dissection of those parts of spawn-fishes has yet been attended to by observers of sufficient scientific skill. It would make a philosopher's fame were he to clear up this obscure portion of natural history. Nebulæ in the heavens seemed much in the same state of obscurity until Lord Rosse produced a glass which unfolds their complexure to our vision, and disseminates them as sparkling orbs over an expanded field, to our astonishment and admiration! Why should spawn, any more than nebulæ, be beyond the reach of philosophy?

But, as salmon have hitherto bred without our assistance or knowledge, we turn to another branch of the subject, namely, to consider the past and present modes of preserving and capturing salmon when produced, and to point out some deficiencies in the present law, and the way to amend it.

For the preservation of salmon to themselves exclusively, it is needless now to enumerate the laws our ruling landlords have got enacted, tried, abandoned, and superseded, as every succession of new heirs to estates have found fault with the law then existing, and contrived to legislate anew for themselves. Our last discarded *Tweed law* was this:—The river to be closed for all sorts of salmon fishing on the 10th of October, and opened again on the 10th January, vainly imagining to enclose the spawning season within these three months. It was discovered, erelong, that the best of the fish were still unspawned at the opening, and then leistered promiscuously.

The latest act of legislation is this:—The river to be closed for *net* and *leister* fishings on the 15th October, and for rod-fishing on the 7th November, and to open on the 15th February. Protection in close-time, under this act, is attempted by a sort of association of the proprietors of waters, with a constabulary force, under the local name of *water-bailiffs*, to go about day and night, for the purpose of preventing, seizing, and convicting poachers.

The impression of the public is, (however erroneously,) that their natural rights being at all times rather arbitrarily abridged by an assumption of claim and privilege, they consider *close-time* as the period when the claiming proprietors suspend their personal superintendence, and delegate their protective powers to the care of their representatives, the water-bailiffs. Hence close-time is considered the poor-man's or *poacher's* open time; as he finds he can always more easily mislead or evade a watching bailiff, than a local *laird* or *tenant*.

The mode of fishing most easily prevented by the bailiffs is the simplest one, and can do least harm to the spawning fish, namely, *the rod*, while *cairn* and *stake-net* poaching are difficult to detect in the dark of night.

But of all fresh water piracies, desperate, daring, cruel, and devilish, is the leistering or spearing with night lights, and being prevented from all other more sportsman-like methods, this the poachers fall upon, and will effect their purpose by, in spite of all the police force that can conveniently be arrayed against them. Leistering can be effected on spawn beds, by two or three individuals, one to hold the torch, another to use the spear. But as, in the use of lights, they have no sufficient protection from a surprise from the bailiffs, the poachers associate in bands of twenties, thirties, or fifties, (poor fellows, often at that season idle, and therefore daring and desperate,) from all the districts around, and, disguised in rags and blackened faces, proceed, like tribes of Indians, to the massacre. Rushing to the spawning gravel beds, over which the flaming lights are kindled, behold fifty or a hundred pairs of fish all promiscuously slaughtered in the very act of spawning, and (as I presume) of impregnation for the succeeding season.

A dozen of bailiffs, who have stolen to the spot with a view to prevention, look stupified while standing on a cliff of a winter night, in witness of such a scene as this, more bewildered than was "Tam O'Shanter" when viewing the witches' dance to the devil's piping.

This has long been, and still is, the prevailing practice in the higher districts of the river, where the greatest number of fish have got up by the autumn and early winter floods, for the purpose of spawning. And it is prosecuted with the greater faci-

lity, by being winked at by the smaller proprietors or tenants, who find it to be less their interest to prevent than to share in the spoil. And it is aggravated as a consequence of the incessant net-fishing at and near the river mouth, where the clean fish are mostly all caught in summer, with little chance of getting up the river till the high floods in the fall, when the nets are laid aside, either on account of the strong floods, or the close-time having commenced. Then the fish run up in shoals to spawn, under protection of the upper water proprietors, to whom, properly speaking, close-time is no special benefit. Such a dialogue as this may at times be heard between a farmer's servant and his master at close-time—" Maister, twa or three o' us are thinking o' lighting a bit bleeze at the *reds* the night, up at the *Shaw-brae-fords*, whar we saw them tum'lin up this afternoon, like brewer's swine drunk on *maut-draff*." " Weel, Davie, I daresay, for my part at least, ye may just take what ye can get when ye have them here, as I am sure I havena seen three good fish in our water through a' the simmer. They *kep* them a' about *Berwick* an' *Norham* now, wi' their lang nets, except just a while at the tail o' the season, when the floodings get ower heavy for their net warks." So, under such supreme permission, Davie raises a band of comrades, with leisters and staves of tar-barrels for lights—a band perhaps nearly as strong as Rob Roy's black-mail clan, and such as a regiment of dragoons could scarcely capture, kill, or disperse.

Thus the havoc proceeds, indiscriminately, on fish in all respects out of season; and half-spawned or newly-spawned salmon is certainly most disgusting food; though, as a poacher would say, " a fish is a fish, if you can catch it, when, where, and how you can." And this is pursued recklessly, regardless of the depreciation of the value of the fish, or the destructive effects on the species to future generations. This is bad enough work for lawless men; but the scene that follows, agreeably to law, on " bonny Tweedside," is little, if any thing, better.

On the evening of the 14th of February, the salmon which are held by the authorities as poisonously unclean, on the morning of the 15th are understood to be duly purged and cleansed *by law*, and made dainties fit for the tables of the rich, and the London market. Now the gentleman's *sport*, as it is termed, begins, which, in many of its particulars, is but a slight refinement of the above-mentioned massacre also; for some of the fashionables of the day delight in boat-lights and leister, dashing that vile instrument through the body of unguarded creatures whilst in the most interesting act of their nature—the propagation of their species, and whilst their flesh is in the most unfit state for human food. Indeed, all the means so reprobated, when used by the poor poacher, are resorted to by themselves under the pleasing desig-

nation of *sport*, without the poacher's plea of something akin to necessity.

Now, if great proprietors consider that the produce of the running waters is as important to them as the production of solid land, we think they might easily contrive to make the rivers which run through their estates teem with benefit to their own interest, as well as conduce to individual amusement of the most fascinating description. Both these objects might easily be attained by entirely abolishing the practice of all *net* and *leister* fishing in all rivers, from the sea upwards to their source; and, instead of expending their money maintaining a bailiff force, they would create funds to take in perpetual lease all the net fishings at the river's mouth, and there refrain from the use of the net, they would certainly preserve a free run of fine fish throughout the whole year. If the net fishings are worth being rented by individual tacksmen, they are surely worth more in value, (overlooking the sport,) to the whole proprietors of seventy miles of the Tweed. Those rents would be, individually, a mere fractional consideration to the rents that might be drawn in letting mile-lengths to gentlemen rod and line anglers, who cannot, under present arrangements, be one-hundredth part accommodated. The benefit, too, to the localities where the anglers would be thus attracted by their favourite amusement, would be worthy of consideration. The distribution of salmon, in the river generally, would depend solely upon casual floods throughout the year. There would always be plenty of fish for the *rod;* many would live to attain to a great size, and rod-fishing would then be one of the most pre-eminent, desirable, healthful, and exhilarating standard amusements of our country. It would beat Grecian games, as well as English horse-racing and hound-coursing, all to nonsense. The bodily exercise then would place the angler on the top of the calculation of the bill of health. The excitement would be one of the most nourishing principles of the mind, without the engrossment of the faculties from higher pursuits. It would be a charming relaxation from sedentary employments and severe studies, besides an honest source of livelihood for a few poor fellows like myself, who, living by the side of the waters, have, from observation and practice, acquired a taste and use of hand in practical fly-dressing, and the preparation of other necessary tackle, rods, and lines, to dispose of to our richer amateurs of high fancy for the "gentle craft."

No close-time would then be necessary, only just such as the river proprietors might mutually agree on, as a partial forbearance amongst themselves. Always having it in their power to restrict non-proprietors, which they already have all the season, on what they claim as their own waters. Because, in rod-fishing,

the spawning fish are less liable to be taken than those in a more seasonable state; and second-best to the winter clean salmon in his splendid silver beauty, are those which come up with the late November, December, and even January floods, for the natural purpose of a fresh-water excursion, as well as the ultimate object of spawning before their return to the sea. These are then in a much better state for slaughter, than in February, March, and April, when only partially spawned, or on the eve of spawning. Besides we have the following, in December and January, in excellent state; namely, the transient clean salmon, the brown twenty-pounders of the *grey school* tribe, with not so much as eight ounces of milt or roe in their belly, in as good condition as a grass-fed ox, and excellent state for eating. All these live in the same pool together, while another pair of the more early fish are spawning on the gravel ford above, and thus the most easily reached by the poacher's spear, who, rather than want all, will take what he can get at with the least trouble. By the time the water opens, the fish in good season, in close-time, have got full of roe and milt, and are ready to spawn in the spring months, many not spawning till April, and even May, and yet these are slaughtered in their *full* state, agreeably to law, on the opening of the river, with as little reluctance as by the hand of a poacher.

Here then is a blundering and ill-conditioned state of matters; while simply by having no specified *close-time*, but a proprietory personally understood protection, which would be conducive to the saving of two-thirds of the whole salmon in either way slaughtered.

No proprietor kills his game, his partridge and pheasant, in the breeding season! Why should he his salmon? Because he feels himself under the thraldom of an absurd law, which he himself has assisted in the enactment. As for the public, they become poachers only because they are excluded from fishing at all seasons; for not one poacher out of fifty would spear a breeding fish, or spear a fish at all, if he could get an occasional, even solicited, favour from a gentle water-proprietor, of a *cast* with the rod, in the fine stream above, or the deep fly pool below, where the best fish lie. One fish got by such fair means, would be preferable in his regard to a night's havoc of the *redding*-fish in the spawn beds.

Poor men are not verily such ruffians as some rich men deem them, and their gratitude lies dormant only where no generous trust or favour is bestowed for its exercise. This is the feeling generally amongst workmen; a few with other dispositions are only the exceptions, whom the mass discountenance, as a degradation to their class and common nature. As, for instance,—For several years past, a few men from some of our

manufacturing towns got long pout nets, with which they sallied forth on summer evenings, taking a cart along with them, frequently many miles' distance to some of our finest trouting streams; such as the *Ayle*, the *Leader*, the *Gala*, the *Jed*, the *Ettrick*, the *Yarrow*, the *Slitrig*, and even the *Tiviot*; where, by two or more of them travelling the net in the water, or holding it fixed in a throat of the stream, whilst others traverse and splash in the water downwards from above, with branches of trees or some white object, making all the fish run into the net, they soon harry a mile or two of water of every trout above the size of a par. Loading their cart therewith, they go into a by-road in the vicinity of a town, in the morning; where, equipping themselves with trout-baskets and sham fishing-rods, call at the houses, and soon sell their cargo. These rivers were thus of course soon rendered useless for the more moderate recreation of the rod angler, till at length the practice became so notorious, that these perpetrators were not only shunned by all anglers of their own sphere of life, but a particular act of parliament against the use of such nets was sought and obtained by the Earl of Minto. This of course was done in favour of the true disciples of old Walton.

The vile practice being still followed clandestinely, last spring a few amateurs subscribed a fund at Hawick for the prosecution of all such offenders under Lord Minto's act, and which fund every lover of fair trouting should, as in duty bound, support. It is hoped the outrageous practice will be put down. For of all earthly recreations, that of a start for a day along a fine trouting stream, like my native *Ayle* water, by grassy bank and alder copsewood, with the excitement of having something to pursue as an object of exercise, either alone, or in company with a cheerful associate, has a perfect charm in it, giving a refreshing relish to the existence of the recluse of art, or the son of craft, shut up the year long in the stalls of labour; where even a rat, though fed to the full, would tire, and eat his way out through a deal board. It is disheartening to be prevented taking such occasional exercise of lith and limb, soul and heart, mind and bo[illegible]

> May never se[illegible] know it—
> But living [illegible] freedom is my ain.

[illegible] proprietors were convinced of the propriety [illegible] my suggestion [illegible] regards legitimate rod-angling—our nobles, being mostly keen anglers themselves—being a great means of improving the salmon fisheries, it would render our lovely Tweed the mo[illegible]ting salm[illegible] ever on the earth's surface for rod-[illegible] [illegible] fine salmon all the year

through. Grand in this respect as it is in others, occupying the delightful vicinage of refined cultivation, and romantic pastoral, it would become unrivalled as a pleasurable retreat! There are no lions in the way now—no Border wars or dungeon keeps, but English and Scotch friends, all brothers in good fellowship, as they ought to be, and I hope will continue to be. The fish would thus become plenty for the rod, and many get leave to live to grow to a large size, as in "auld langsyne," before the Berwick netting proprietors became so formidable as to capture all their fish at half age; and at the same time stultify the upper river proprietors, by coaxing them to associate for a close-time protection of the remnant that had escaped their net warpings by favour of providential high floods and Sabbath rests, and which reach the upper streams to propagate their species, only to keep up a supply for the sole use of themselves, the Tweedmouth Netting Proprietors.

Should the lower proprietors not agree to some reasonable compromise, the upper ones should apply to the legislature for an Act of Parliament either to abolish all net-fishings whatsoever, or to leave the water every second twelve or twenty-four hours clear of nets, for the express purpose of allowing the fish to have a free run from the sea to above tide-mark. Such terms would be a greater concession to the under-water proprietors than reason and equity would dictate; and, indeed, such a concession might be enforced by the upper proprietors withdrawing protection altogether, and letting the poacher settle the supply in a summary way, when the Tweed-mouth proprietors would have to exercise their ingenuity to find a continued succession of clean fish for themselves.

Upper proprietors need, therefore, no close-time laws in order to prevent poachers, if they were only true to themselves; and in place of denouncing by law, to fine and imprisonment, their poor neighbours, for an occasional exercise of the use of the fly and the rod, they would duly consider the state of matters within tide-mark, they would there find something more worthy of their consideration.

THE FARMER'S NOTE-BOOK.—NO. XIV.

Goats. By JAMES H. FENNELL, Author of "A Natural History of Quadrupeds."—An ordinary observer, even a shepherd, were he to see a collection of all the numerous foreign species of goats and sheep, would in some instances find himself puzzled to say whether some of them were sheep or goats, so closely at first sight do some sheep resemble goats, and some goats resemble sheep. Indeed, none but a zoologist would be able to pick them out with certainty. This, however, is not nearly so surprising as it is to find some persons so little discriminating as to give the name of Peruvian sheep to the llama, an animal that is neither a sheep nor a goat, but the next genus to the camel.

To establish a generic distinction between sheep and goats, Cuvier points out that sheep have "their horns directed backwards, and returning more or less forwards in a spiral manner, with a generally convex line of profile, and no beard; while the goats have their horns directed upwards and backwards, their chins generally decorated with a long beard, and their line of profile almost always concave." To these differences some writers have added the woolly fleeces of the sheep, and the hairy covering of the coats; but all the wild sheep, and even some of the domesticated races, are clothed with long hair; and many of the cultivated varieties of goat, those of Thibet and Angora for example, are remarkable for the length and fineness of their wool. The horns, too, vary so extensively in both cases, and the convexity of the line of profile is subject to so many modifications, as to render the distinctions drawn from these characters of little practical value. On the presence or absence of the beard it would be absurd to dwell as offering the semblance of a generic character, to distinguish between animals which actually produce together a mixed breed capable of continuing their race. These considerations would lead us to infer that the sheep and goat cannot properly be said to form the types of separate genera, if naturalists had not succeeded in detecting certain other characteristics by which goats are more readily to be distinguished from sheep. Goats have not the distinct lachrymal groove which all sheep possess, and, as Blasius observes, the forehead in goats rises to a steep protuberance; in sheep, it is flat, or even somewhat hollowed. In all species of sheep, the greatest diameter of the horn is across the longitudinal direction of the head; while in all species of the goat, it runs parallel with it. The goats have, on the anterior side of the horns, at each constriction, two or three stronger transverse knobs between the smaller cross-waves; the sheep only moderate cross-pads. In goats, the form of the hoof,

viewed sideways, is four-sided, trapezoidal, scarcely higher before than behind; in sheep, it is three-sided, running out to a point posteriorly, like a goat's hoof cut through diagonally.

Most zoologists are of opinion that the common goat is derived from the paseng (*Capra Ægagrus,*) which is the wild goat of Persia and of the Caucasian mountains. In some parts of Britain, more especially in the most inaccessible parts of the Welsh rocks and mountains, goats roam about without the slightest appearance of ever having been domesticated, or of having been derived from a domestic stock. Pennant says, they were in his time suffered to run wild on the rocks in Caernarvonshire, during such seasons as they were not in request; but when needed they were either shot with bullets or hunted with dogs. These Welsh goats, which are now rarer on the mountains than formerly, are much larger, and their hair is longer than those of England. Pennant saw a pair of their horns which were three feet two inches long, and three feet from tip to tip. The ordinary colour of the domestic goat is black and white, or a dull light reddish brown, with a black line down the back. The large herds of goats possessed by the inhabitants of the mountainous island of Achill, in Ireland, are almost invariably white. The goat's beard is often very long, particularly in old buck or he-goats.

Goats are particularly adapted for inhabiting high and comparatively barren altitudes. A goat will display the greatest agility and sure-footedness in attaining to and resting upon the jutting points and crags of rocks, and its appearance is surprising when seen thus poised, with hardly any place for its feet, upon the sides and by the brink of most tremendous precipices in the Alps and other mountainous countries. Pliny relates that two goats having met one another on a long bridge which was too narrow to allow of their passing one another, neither of them would go back, but one lay down, and permitted the other to pass over him. Dr Clarke, when travelling from Jerusalem to Bethlehem, saw an Arab exhibiting a goat which he had taught, while he accompanied its movements with a song, to mount upon little cylindrical blocks of wood, placed successively one above the other, and in shape resembling the dice-boxes belonging to a backgammon table. In this manner the goat stood, first upon the top of one cylinder, then upon the top of two, and afterwards of three, four, five, and six, until it remained balanced upon the top of them all, elevated several feet from the ground, and with its four feet collected upon a single point, without throwing down the disjointed fabric upon which it stood. The diameter of the upper cylinder, on which its feet ultimately remained until the Arab had ended his ditty, was only two inches, and the length of each cylinder was six inches. This exhibition, which strikingly

shows the tenacious footing possessed by the goat, is very ancient, and is also noticed by Sandys.

When left to forage for themselves, goats generally select for food bitter and slightly astringent plants, as the leaves and buds of spurge, hemlock, birch, privet, and bird-cherry, and the tender tops of furze and heath. Theocritus alludes to the eagerness with which they seek the laburnum; and Virgil celebrates that tree for increasing their quantity of milk. Franzius, who observes that goats are delicate feeders, biting off only the tops of branches, says, they "most of all love to feed on the bark of the beech-tree, as also on the leaves of shrubs and hedges." He adds, that "those in Arabia do exceedingly love cinnamon, and if you have but any cinnamon about you, they will follow you any where." Phillips speaks highly of the leaves and young branches of the single-seeded broom (*Spartium monospermum*) as food for goats. Loudon says, that in France, willow-leaves, either green or dry, are considered the very best food for them; but their most favourite food appears to be the leaves of the honeysuckle—hence the French call it *chévrefeuille*, or goat's-leaf. Goats are fond of hellebore, and will fatten upon it, although it is poisonous to man. Linnæus states that they will eat of the yew-tree with impunity, though horses and cows refuse to do so. The author of *Campaigns and Cruises in Venezuela*, says, goats will browse without injury on the leaves of the poisonous manchineel tree. It is also stated, that goats will readily eat manufactured tobacco without suffering from its noxious effects. Dr Macculloch, in a letter to Sir Walter Scott, mentions a he-goat on board ship, whose diet consisted, except on holidays, of pig-tail tobacco, carpenter's chips, and kippered salmon. "The depredation on the fish," he says, "became so serious, that we were obliged to hoist them into the shrouds out of his reach. Indeed, I never could discover any thing which the goat would not eat, except oakum, which always puzzled him." During winter, goats will feed on indifferent hay or straw, furze, heath, thistles, cabbage-leaves, potato-peelings, old ship-biscuits, or, in fact, almost any thing that is presented to them. In wooded districts they do much damage by barking the trees.

The Greeks and Romans used to call their she-goats to feed by the sound of a *buccina* or horn.

The variety and coarseness of the goat's food, the hardiness of its nature, and the ease with which it accommodates itself to either an out or in-door life, enable the small-landed cottager to keep it nearly as well as the farmer. The parishes about Mont d'Or, near Lyons, without pasturage or meadows, support nearly twelve thousand goats, kept in stables throughout the year, and yielding a produce of more than a million francs. It is a common

notion, perhaps a correct one, that horses enjoy better health when a goat is kept in the same stable. Professor Bell thinks, that this is owing to the activity and good-humour of the goat keeping the horses in better temper and cheerfulness than they would be in if left in solitude. This might seem tenable where a horse had no companion of its own species; but in stables where several horses are kept there is no solitude. In Marshall's *Rural Economy of Gloucestershire*, some cases are related to show that the presence of goats in stables protects the horses from the staggers, which he says is evidently a nervous disorder. Then he suggests that the goat, by exhaling its well-known odour, serves the purpose of a smelling-bottle to the horse, whose nervous system is benefited by the strong scent. But as we know that the goat eats of many plants which would prove injurious, if not poisonous, to the horse, it is not improbable that the health of the latter is preserved by the goat picking the baneful plants out of the fodder. To account for its salutary influence, perhaps these three conjectures should be taken together.

However closely confined, goats are still very healthy animals, and are excellent live-stock for ships; for, when sea-voyages are so stormy as to kill geese, ducks, fowls, and almost pigs, goats will continue well and lively; and when no dog can keep the deck for a minute, a goat will skip about with impunity. The goat seems able to bear any climate, and, wherever it has been introduced, it seems to have rapidly multiplied. Mackinnon, in his *History of the Falkland Islands*, (1840,) observes, that "goats are found in one or two of the islands near West Falkland, and have increased amazingly, for the original stock were only landed a few years ago by a whaler."

Goats appear to reach a greater age than sheep. When Alexander Selkirk was on the Island of Juan Fernandez, he caught above five hundred goats, which he marked on the ear, and then let them go. In Commodore Anson's *Voyage*, it is mentioned that the Centurion's men found on the island several venerable goats, which, from having their ears slit, they concluded had been caught by Selkirk, who was left upon the island about thirty-two years previous.

The he-goat engenders at a year old, and one individual suffices for more than a hundred females. The she-goat can produce when seven months' old, and goes with young five months. She generally yeans two kids. We learn from the *Literary Gazette*, (No. 944,) that some years ago a goat belonging to Mr William Money produced five perfectly formed kids at a birth—an unusual occurrence among ruminating animals. Franzius remarks, that " some people make cheese of goat's milk, but it is very rank." The milk itself, though it yields but little cream, is

highly nutritive and useful in several diseases. Dr Gooch recommends, that when infants cannot be nursed by their own parents, they should be allowed to suck a goat—the best animal for this purpose, being easily domesticated, very docile, and disposed to an attachment for its foster child. The goat lies down, and the child soon knows it well, and, when able, makes great efforts to creep away to it and suck. Abroad, the goat is much used for this purpose; the inhabitants of some villages take in children to be thus nursed; the goats, when called, trot away to the house; and each one goes to its child, who sucks with eagerness, and the children thrive amazingly. A curious story is told by Herodotus, (Lib. II.,) of a question that arose between the Egyptians and the Phrygians concerning their priority, which King Psammetychus undertook to decide thus:—He commanded two infants to be brought up by a shepherd amongst the sheep, and ordered that no one should speak a word to them, and that they should suck a goat, which accordingly was done. The shepherd was to observe the first word the infants spake, and at a certain time he heard them cry out "beccus," which they often repeated. After a long research, the king ascertained that this word signified bread among the Phrygians; and therefore, ever after, the Egyptians acknowledged the Phrygians to be the more ancient nation, although *weken* signified bread, and *becket* signified a baker.

A pint and a half of milk a-day is frequently yielded by a goat; and when the kids are killed at a few days old, the goat will give nearly two quarts of milk, being seldom dry many weeks in the year.

The flesh of the goat, especially of kids, is eaten, and by some esteemed a delicacy; the haunches are frequently salted and dried like bacon. Weston, in his *Tracts on Agriculture*, suggests that "it is not improbable but that kids, fattened as house-lamb, would sell well, and soon prove of great national advantage."—(P. 129.) In Wales, the suet is much used for making candles, which are of superior whiteness and excellence to those made from sheep or ox suet. The skin, particularly that of the kid, is a valuable material for the manufacture of gloves. Wigs are made of the longest, thickest, and whitest hair which grows on the buttocks of the he-goat. It is singular, as Cuvier and St Hilaire justly observe, that no European has yet availed himself of the wool produced by most of our domestic goats, which, though less delicate than that of the Thibet goat, would have undoubtedly yielded a web much finer and more even than the most admired wool of the Merino sheep.

It is a striking coincidence, that the goat was ranked among the sacred animals of the Egyptians, and the worship of it was

among the charges brought against the Templars; and, in the sixteenth and seventeenth centuries, we have abundant proofs, in the trials for witchcraft, of the prominent station assigned to this animal by superstition.

Cuvier notices the remarkable fact, that although goats are found in a wild state in three quarters of the globe, and perhaps in the fourth, and sheep most certainly exist in a very great portion of the world, New Holland perhaps excepted, geologists have not discovered any fossil organic remains of either extinct or existing species of these genera.

*Memorials of John Ray.**—A Society like the Ray Society, can safely embark in the publication of expensively illustrated works on natural history, and elaborate scientific treatises, which the generality of publishers would not venture upon putting to press, from apprehension of a want of sufficient purchasers to cover the outlay. At the present time, the Society consists of nearly two thousand members, who receive three publications in the year in return for an annual subscription of one guinea. We may reasonably expect that the annual number and value of the publications will increase proportionately with the increase in the general fund, consequent on the influx of additional members. When such a society is large, one advantage is, that a member may have not only the full value, but even double or treble the value of the amount he subscribes: such is the consequence of an extensive combination of small means.

The Ray Society started in February 1844, making these four promises to the public: namely, to print original works in zoology and botany, and to re-issue works of established merit, to reprint rare tracts and manuscripts, and to translate foreign works. Judging from the nine public publications which have appeared, and some few others that are announced, it would seem that two of these promises—the re-printing of rare tracts, &c., and the issuing of new editions of valuable works—are quite forgotten, so absorbed are the council in printing an endless work on a subject which only one naturalist in a hundred can possibly study, and in pouring forth not the most intelligible translations. We should like to see this course agreeably varied by the reprinting of some of our scarce English works of Queen Elizabeth's reign, or earlier. Then the Ray Society would hold a similar honourable position in literature which the Sydenham and Camden Societies have acquired. Let them look to this point, and be mindful of their promises.

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* Printed for the Ray Society.

Appropriately enough the Society commenced their labours with the volume now before us, which is adorned by a picturesque frontispiece of Ray's tomb in the churchyard at Black Notely, Essex. The volume is altogether very entertaining; but we regret that we cannot praise the editorship of it. Such a work should have been entrusted to hands well acquainted with the state of science in Ray's time, and antecedent. In the present volume, (p. 17,) Ray mentions reading Dr Sydenham on Fevers, and "the business about Great Rakes," between the years 1663 and 1667; and his annotator, George Scott, says these great rakes "are now (1740) come into general use among the farmers, and are called drag rakes." Inquisitive as we are about ancient agricultural literature, we never heard of this alleged treatise on rakes, nor can we find it enumerated in a chronological scientific catalogue which we have compiled at much labour. Indeed we feel confident that Mr Scott has misunderstood Ray's meaning by "the business about Great Rakes," which we contend has no reference whatever to the farmer's rakes, but alludes to the business, or stir, about one Mr Valentine Greatrakes (or Greatorex, as some call him,) a celebrated Irish quack doctor, who professed to cure diseases by rubbing the patients with his hands. Ray had probably been reading two works that were published in London in 1660; the one entitled Valentine Greatrak's *Account of Strange Cures by Stroaking with the Hand*, accompanied by a portrait, and the other entitled *Wonders no Miracles, or Mr Greatrak's Gift of Stroaking examined.* That Mr Scott's ludicrous translation of this "business" into *drag rakes*, should not have been detected by Dr Lankester is extraordinary, unless we are to infer that he is as little concerned in our ancient medical literature as the Ray Society seem to be with our ancient English naturalists.

Accuracy in dates is of very great importance in biographical works. At p. 71 we are told that the first edition of Ray's *Collection of Proverbs* was published in 1672, while, at p. 111, we are told it was published in 1670; at p. 73, we are informed that he published in 1672 a *Nomenclator Classicus*, while, at p. 112, we are told its first appearance was in 1675; at p. 114, the date of publication of the first volume of his *Historia Plantarum* is given as 1786, evidently a misprint for 1686; and at p. 77, we are told the second volume appeared in 1687, while, at p. 114, it is referred to the year 1688; at p. 95, in the notice of Ray's life, we read—"His favourite *studies appears* to have been *that* of the works of nature,"—instead of saying, His favourite study appears to have been, &c. We humbly think that it is very careless editorship to allow such discrepancies as these to disfigure the Society's publications.

The most interesting portion of this volume consists not of the biographies of Dr Derham, Sir J. Smith, and Cuvier, (the whole of which ought to have been reduced into one good biography,) but the latter half, which contains Ray's travelling memoranda. We propose making a few selections, adding thereto some comments of our own:—

"We rode through a bushet or common, called Rodwell Hake, two miles from Leeds, where (according to the vulgar tradition) was once found a stag, with a ring of brass about its neck, having this inscription—

'When Julius Cæsar here was king,
About my neck he put this ring;
Whosoever doth me take,
Let me go for Cæsar's sake.'"

It is inferred by modern naturalists, and perhaps correctly, that the stag does not attain the age of fifty years, yet Hesiod says, its age is thirty-six times that of a man. The ancients, indeed, famed it for long life; but, as Lord Bacon observes, "not upon any relation that is undoubted. They tell of a certain hart that was found with a collar about his neck, and that collar hidden with fat. His long life is less credible, because he comes to his perfection at the fifth year; and not long after, his horns (which he sheds and renews yearly) grow more narrow at the roots, and less branched."—(Bacon's *History of Life and Death*, edit. 1651, p. 9.) Charles VI. was reported by the people of his time to have taken in the forest of Senelis, a stag which exhibited on the collar the words, *Cæsar hoc mihi donavit*, which induced some to suppose it more than a thousand years old, reckoning from the time of the Roman emperor, instead of reflecting on the greater probability of its having escaped from Germany, whose emperors were also called Cæsars. "Ricius Patricius noteth in his book, intituled *De Regibus Galliæ*, (Of ye Kings of France,) that Cæsar being about ye forest of Arden, tooke a stagge, and caused a collar to be put about his necke, with these words, *Cæsar hoc me donavit*, (Cæsar gave me this.) That stag was not killed three hundred years ago; it should seem that this was done of Cæsar in no other respect, but that the long continuing age of that beast might be knowen, which, before that time, none, or very few, hearing of it, would believe to be true."—(Reynolde's *Chronicle of all the Noble Emperours of the Romaines*, 1571, p. 12.)

Ray being at Knaresborough, August 3 1661, visited St Robert's little chapel on the river Nid, and, from an old dame who exhibited this place to strangers, he received the following legends of St Robert. King John sent some messengers to St Robert to tell him that he must leave off his devotions in the chapel, and come to him at the castle of Knaresborough; but—

"St Robert refused to go, and sent the King an ear of corn, with these words, that he was serving him who made that, and unless he could make such another, he would not attend on him till he had finished his devotions. A second legend is, that St Robert going to the King, complained to him that his deer in the forest of Knaresborough did the poor men's corn much harm: the King merrily asked him why they did not pound them; whereupon St Robert catcheth two of the stags, and putteth them into the pinfold; the King, wondering at it, asks him what he would desire in recompense for the poor; the Saint answered, only as much land as he could plough round with two stags in the time of divine service. The King granted his request, he encompassed a great quantity of land, which is now in the occupation of the Slingbyes. The picture of the plough and bucks is in one of the church windows at Knaresborough."

This is the first time we have ever heard of putting stags to the plough, and whether true or not, the story is curious and amusing. In what follows we have an early example of the now fashionable system of hydropathy. August 5, 1661, Ray went from Harrowgate Spa

"To St Magnus his well at Copgrave, whither a great number of poor people resort to bathe themselves; they put on their shirts wetted in the water, letting them dry upon their backs. This water operates, if at all, by its extraordinary coldness and astringency."

Under the date of August 9, 1661, Ray makes a memorandum at Whitby, which alludes to the fossil ammonites, or *Cornu ammonis*, which are still found there. Referring to Camden, he cites the story that St Hildas by his prayers delivered the country from snakes, which were changed into the very hard round stones which are found in the alum mine near Whitby, and are called catsheads by the workmen. They are now more generally known by the name of snake-stones. Further on, under date of July 22, 1671, Ray mentions his gathering on the shore at Holy Island, "those stones which they call St Cuthbert's beads, which are nothing else but a sort of entrochi." We are informed that these remains of fossil radiati, which are about the size of the seeds of the mallow, of a dark leaden colour, with a brownish speck in the centre, are still found in great abundance among the rocks at Holy Island, and are purchased by unscientific strangers, from a vulgar notion that they are the genuine workmanship of the saint, and were used in the rosaries worn by his devotees. Tradition still gives out that this holy gentleman often visits the shore of Lindisfarne in the night, and, sitting on one rock, uses another as his anvil, on which he forges and fashions the beads, as they call them. Walter Scott says—

"Saint Cuthbert sits, and toils to frame
The sea-born beads that bear his name."

MARMION.

On the continent, these little fossils have been known by the name of Nummuli Sancti Bonafacii, or the small cash of St Bonaface. Near Roseberry Hill, at Gisborough, Ray

"Went to see a well celebrated for the cure of sore or dim eyes, and other diseases. Every one that washes in it, or receives benefit by it, ties a lacinia, or rag of linen or woollen, &c., on a shrub or bush near it, as an offering or acknowledgment."

We may add, that this is a very common practice at the holy wells in Ireland.

Pursuing his journey north, Ray reached the town of Dunbar, August 17, 1661, where he notes that

"The Scots, generally, (that is the poorer sort,) wear, the men blue bonnets on their heads, and some russet; the women only white linen, which hangs down their backs as if a napkin were pinned about them. When they go abroad none of them wear hats, but a party-coloured blanket, which they call a plaid, over their heads and shoulders. The women, generally, to us seemed none of the handsomest. They are not very cleanly in their houses, and but sluttish in dressing their meat. Their way of washing linen is to tuck up their coats, and tread them with their feet in a tub. They have a custom to make up the fronts of their houses, even in their principal towns, with fir boards nailed one over another, in which are often made many round holes or windows to put out their heads. In the best Scottish houses, even the king's palaces, the windows are not glazed throughout, but the upper part only; the lower having two wooden shuts, or folds, to open at pleasure and admit the fresh air. The Scots cannot endure to hear their country or countrymen spoken against. They have neither good bread, cheese, nor drink. They cannot make them, nor will they learn. Their butter is very indifferent, and one would wonder how they could contrive to make it so bad. They use much pottage made of coal-wort, which they call keal, sometimes broth of decorticated barley. The ordinary country houses are pitiful cots, built of stone and covered with turves, having in them but one room, many of them no chimneys, the windows very small holes and not glazed. In the most stately and fashionable houses in great towns, instead of ceiling, they cover the chambers with fir boards nailed on the roof within-side. They have rarely any bellows or warming pans. It is the manner in some places there, to lay on but one sheet as large as two turned up from the feet upwards. The ground in the valleys and plains bears good corn, but especially beer-barley or bigge, and oats, but rarely wheat and rye. We observed little or no fallow-grounds in Scotland; some layed grounds we saw which they manured with sea-wreck [see-weed.] The people seem to be very lazy, at least the men, and may be frequently observed to plough in their cloaks. It is the fashion of them to wear cloaks when they go abroad, but especially on Sundays. They lay out most they are worth in cloaths, and a fellow that hath scarce ten groats besides to help himself with, you shall see come out of his smokey cottage clad like a gentleman."

This is not the most flattering picture of our ancestors one hundred and eighty-five years ago, but there is abundant other evidence for believing it to be correct. On the general state of their education he is silent; but he mentions that while he was in Scotland, many women were burnt for witches, about a hundred and twenty, according to report.

We wonder whether the cause of the following fact has yet been discovered:—

"The teeth of the sheep are died yellow that feed on a hill called Trysillum, [near Beaumaris,] where some have conjectured there are gold mines."

Near Tenby, Pembrokeshire, Ray saw some people engaged in

"Burning cockle-shells, thereof to make lime. They made a hole in the ground,

therein they put furze, upon that wood, upon the wood small stone coal, and then a layer of cockle-shells, and so shells and coals, layer above layer, and then put fire to them; these burnt make excellent lime. * * * In Devonshire, as well as Cornwall, they manure or mend their land with sea-sand."

The application of stable manure to the soil is much more in vogue with us moderns than the prescription of it to cure sick people. Ray informs Dr Lister that in the spring of 1671, he was afflicted with a feverish disorder which ended in the yellow jaundice, but he was soon cured of it by an infusion of stone-horse dung with saffron in ale! How would this mixture have suited Falstaff, who could not endure lime in his quart of sack!

Two curious instances of abstinence from food are cited by our author. In Salisbury Cathedral he noticed the tomb of Dr Benhet, who is reported to have attempted, in imitation of our Saviour, to fast forty days, but expired on the seventeenth day of the experiment. Ray was also told of an old man at Hereford, named Rod, who had never drunk milk, nor eaten any butter, cheese, fish, nor flesh, excepting the skin of a roasted pig!

We shall select but three more interesting notices:—

"In Somersetshire they have a way of setting their mows of corn on a frame, (which they call a mowstead.) standing upon four stones cut with a shank, and upon that a head like a meta, resembling some toad-stools."

"We observed no parks in Cornwall; their fences are for the most part earthen or stone walls; often, instead of a stile you have only a gap in the wall, and a grate to pass over, after the manner of college grates, only ruder, and of wood or stone."

"That the influence of soil and climate is great, appears in our Lancashire and Sussex beasts; of which the former have fair, large, and well-spread horns, the latter small and crooked; and if into Sussex you translate these cattle out of Lancashire, their race by degrees will degenerate, and come to the shape of the natives. So we see the horses in Flanders have large and hairy pasterns, which the English breed have not; and it is reported for a truth that there is a pasture upon a hill called Haselbedge, in the Peak of Derbyshire, near Little Hucklow, which will turn the hair of kine that feed thereupon to a grey colour in three years' space."

Characteristics of 1846. By Mr Towers.—I commence my annual notice at the period of 1845, when winter, to all intents and purposes, really commenced, and I propose to conclude it at the like period of the current year. It is all very well, in an astronomical point of view, to make the commencement of the winter, spring, summer, and autumnal quarters to fall in with the four great cardinal periods of the year, namely, when the sun appears in the first degree of Capricorn, of Aries, of Cancer, and of Virgo; but, agriculturally considered, the commencement of winter cannot be later in the year than that in which, all the works of autumn being completed, frost and snow are naturally expected to occur; and as these are expected, even in the south of England, early in November, we cannot much err in selecting the twenty-first day as the commencement of our winter quarter.

Before I quit these introductory remarks, I beg to recall to memory the prediction which was promulgated early in 1845, by the publication of Mackenzie's *Cycle of the Winds*, if I do not mistake the title. Be this as it may, it was stated, that whoever lived to witness the phenomena of the year 1846, would have ample reason to recollect the same as altogether astonishing. I quote from memory only; but, while disclaiming any wish to favour or sanction meteorological predictions, it cannot be doubted that the phenomena of the whole agricultural year have been equally anomalous and extraordinary. During the course of my article, I shall endeavour to allude faithfully to these phenomena as they displayed themselves in our southern counties; and I do this with the more satisfaction, as all the agricultural reports tend to prove that our northern neighbours have experienced, at one time or other, similar visitations.

Our public press has amused its readers with occasional reports of the prognostics of the French philosopher M. Arago. That there are certain signs which indicate approaching atmospheric changes, no one can reasonably doubt. The *Book of the Farm*, in the early part of Vol. I., has collected together many of these indications, and there are few persons who have not *felt* the effects of weather. Still, M. Arago is fully justified in denying all the predictions concerning long periods of drought, wet, heat, or cold, which have been assigned to him, and in stating it to be his firm opinion, that no person can, with any degree of certainty, predict what mutation of the weather there may be from one hour to the other.

Having thus repudiated the belief, that any general prediction is worthy of confidence, while it is admitted that there are appearances which, in general, may be deemed trustworthy monitors, I proceed to embody the data furnished by meteorological observations.

NOVEMBER 1845 was, as a whole, a fine month, very little frost had occurred, and in no instance throughout a whole day; there were sixteen days wherein rain fell, but from the 21st, whence we date this article, there were three days, the 25th, 26th, and 29th, wherein the fall was considerable. On the 23d, we had one degree of frost, (31° Fah.,) on the 24th, two degrees; but only at the minimum, or at coldest period of each night. The average temperature of day and night of the last ten days was 44.25°; the lowest depression being on the 24th, when the minimum of the preceding night or early morning was 30°; the maximum of the day 40°; and the degree at ten o'clock P.M. 32°. Wind north-east, lively, and the sky brilliant. With change to south-west, five successive cloudy days followed; the temperature rising to 52° as a maximum, with average about 47°. The month ended beautifully.

Here, the weather and the state of the ground were most favourable to the plough, every thing on the land presented a good aspect, wheat fine, but not gay, and clover a close compact plant. In the heavens, which were very frequently clear, the evenings displayed a gorgeous arch from east to west of all the planets that are usually discernible by the unassisted eye; and when the moon, in its course from the change on the 29th, passed along their positions, the sight was beauteous: we shall rarely be so favoured again.

December commenced as its predecessor finished; but the wind moved back to the west, and there it remained, wavering a point or two to north and south till the 17th, with one exception, the 8th. It was brisk on the three first days, strong on the 11th, otherwise gentle. The atmosphere was clear, with abundance of sun till the 13th; and during this period the barometer attained a great altitude, from 30 in. 10 cts. to 30 in. 40 cts.

On the 14th a total change occurred, after 4° of frost; on the 13th gloom and clouds followed, with much rain, some haze and fogs; on the 19th sleet-showers and furious gusts of wind. The ground became saturated with water; and for a short time ploughing was impeded. During the last ten days of the year, the mutations of the weather may be thus registered:—21st, snow, fierce wind, frosty evening; 22d, snow again, but melting; 23d and 24th, fine, sunny, with lively north and north-west breezes; 25th, 26th, changeable, rainy, boisterous wind, and rain on the 27th; and thus to the 31st inclusive. As a whole, December was fine, and very mild. There were seven days more or less rainy; three with some snow or sleet, nine more or less frosty, (with some rime,) but the greatest intensity was on the mornings of the 8th and 22d, 26° and 27° Fah., but only for a few hours; barometer about an average of 29 in. 70 cts., and thermometer at a maximum average of all the days, 45°, at a maximum of the nights, 34°8.

1846. January opened most brilliantly; the barometer rising to 30 inches; the thermometer, at three observations, showing 38°, 46°, 35°; wind west-north-west. To the 16th day, inclusive, the weather was dry; the first week sunny, with only two very slight frosts of a few hours' duration. The barometer on the 9th rose to the unusual elevation of 30 in. 60 cents., a degree that I never before had witnessed in this locality, which is, I believe, some hundreds of feet above the level of the Thames at Maidenhead Bridge. But the wind had veered to west and south, and the atmosphere soon became quite suffused with clouds, remaining so, with no sun, so long as the wind fluctuated, at some point between east and south till the 18th.

Rain commenced on the 17th, and fell to a greater or less extent in ten days during the remainder of the month. The 18th

was foggy; the 20th, pretty fine; the 27th and 31st were dry, but gloomy; wind, south-west to west. Thus the month was pretty equally divided, one half being dry, the other, to the end, very rainy, so that the ground became saturated with water. The average temperature of all the nights was about $38°\frac{3}{10}$ths; that of the day maximum $45°\frac{5}{10}$ths. The barometer, during the fifteen first days, averaged, at ten o'clock p.m., 30 in. 9 cts.; thence, to the end of the month, 29 in. 4.75 cts. The westerly winds greatly prevailed; on ten days only did the direction vary to the east by south, as above stated.

FEBRUARY came in with very mild temperature—45° to 47°—and a lively breeze from west; the first day sunny and clear till evening; then starchy, cirrus clouds formed, presenting the beautiful phenomenon of a lunar halo. Profuse rain followed, as it almost always does. On the 2d, the sun rose red; drizzling rain and wind succeeded. The mercury began to rise steadily on the 7th—wind west-north-west—thermometer 56° about mid-day. Three sunny days followed, though a slight fall or scud of snow occurred twice; the temperature was much reduced; and there were four frosty mornings—25°, 26°, and 28° of Fah.—but the frost never continued throughout the day. The wind was north-westerly till the 19th, then it backed to west, and settled in the south on the 20th. Scarcely a ray of sun enlivened the scene during twelve days—the 11th and 20th being included—the temperature was much reduced, averaging to the day last named—*minimum* by night, $35°\frac{5}{10}$ths—maximum, $43°\frac{7}{10}$ths. From the 8th to the 21st, the barometer was, on an average, at least 30.08 cents. Then I consider the agricultural winter quarter to have closed; and, in the existing circumstances, it had proved a period that was remarkable for its meteorology, worthy to be remembered and chronicled. During the course of the three months since November 21st, there had not been, *here*, observed one single day frosty throughout. With alternations of high atmospheric pressure and corresponding levity, there were seasons of brilliant hot sunshine, and others of total gloom. The rain was also pretty equally distributed, so that, while the earth was amply supplied, there were no swamping floods. Thus, allowing for the absence of frost—a certain portion of which, it must be granted, is extremely beneficial—the winter was very fine and healthful. What a contrast with that of 1844-5, when, from November to the 21st of March—excepting two or three weeks of January—the land was hard-bound with black frost! One fact, connected with *horticulture*, I beg to register. I have resided in this same spot during sixteen years, and have noticed every season: among others, several very mild, open winters; yet, never before did I see the *fuchsias* that grow in open beds retain their vitality in every twig. Such a

phenomenon has been alluded to; but although I have seen fine green shoots emerge from the old wood in January, they were always killed, and with them the last year's wood itself. In the present year, every member retained life, and produced early, fine blooming shoots, covered with flowers of far superior beauty; and the shrubs have *continued in bloom* till the middle of November. I am not aware that the common species, such as *Fuschia coccinea, grácilis, virgáta*, and two or three others, will prosper in the open gardens of North Britain. With us, we can trust them in common garden earth, without any covering or moulding-up, throughout the most severe weather. Many of my plants have occupied the same spots during ten years. We expect the brittle twigs to die down, and sometimes cut them over in November; but frost, even to zero, as was experienced in 1838, has never yet paralysed the roots of a single plant. . . . .

By referring to the registers of observed average temperature, it will be seen that the mean of December is estimated in the *British Almanac* at 39°; that of January at 36° 1′; of February, 38° Fah. My averages above cited were 49°, 42° nearly, and 39°5′ Fah.; all in excess, though that of February corresponded more closely with the printed tables.

In a season so very mild, it might be expected that the wheat would be "winter proud." That it *was* verdant and rich cannot be denied; but, circumstances considered, I was surprised to observe the *equability* and subdued luxuriance of its growth. It appeared, by the distance of the plant, that seed had been economised in some degree, and, (so far as I could obtain evidence,) since wire-worm had been far less destructive than at the same period of 1845, there remained, at the end of this first quarter, every promise of a healthy and productive result.

Second Agricultural Quarter. Commencing February 21, 1846. On this day a decided change took place, which introduced a great abundance of rain; the weather was warm, 54° by day, 47° at night. Wind south-west, with a little sun at mid-day; 22d, 23d, 24th, 25th, decidedly rainy; the 26th was beautifully fine till evening; then, and on the 27th, there was some rain. The sun set red, tinging the clouds with a crimson effusion; and the 28th was most superb, with a maximum heat of 58°; the barometer rising from 29 in. 70 cts. to 29 in. 94 cts.

MARCH came in with lively air at south-west; but a change occurred, the mercury falling as rapidly as it rose, and by the 5th day was below the mark changeable, being 29 in. 47 cents. Showers occurred daily till the 6th, which was very fine, as was also the 7th, excepting one shower of hail. The wind continued westerly, with little deviation till the 16th, inclusive; and no more rain fell till *that* day, which may be noted as the termination of

the warm weather. Up to that time the minimum, or lowest average of all the nights, was 40° 75 cent.; days, 53°, within a slight fraction.

We now approach the vernal equinox—a period which must be deemed very important, whether we believe that it furnishes a criterion whence to judge of the ensuing summer, or that we view it only as a precursor of those winds, more or less stormy, that have borne the name of the equinoctial gales. Kirwan entertained an idea that the character of the winds and storms of the equinox indicated that of the ensuing season. I embodied this theory with another in the Naturalist's Calendar of the *Domestic Gardener's Manual*, Edit. 1839, p. 29, thus:—"The *vernal* equinox takes place during this month, and experience seems to authorise the conclusion, that, according to *the character* which the weather assumes about that period, the succeeding summer will, in all probability, be *either wet or dry*." Kirwan said—"If there be a storm at south-west, or west-south-west, on the 19th, 20th, 21st, or 22d of March, the succeeding summer is generally wet five times in six." The northerly gales afford an opposite indication. I have not the passage before me, but, independently of meeting with a good authority, which, in 1820, induced me to watch and note down the equinoxes, I have found, with extremely few variations, that those periods have generally given very correct indications, and shall now, commencing with March 17th, endeavour to produce some direct evidence of the application of the theory.

On the 17th, the wind changed to north-east; the atmosphere became brilliantly clear, and the thermometer fell to 36° Fah. The following morning saw it at 28° (4° of frost;) a powerful sun raised it to 41° at mid-day, but the mercury declined to 32° at 10 p.m. On the morning of the 19th, it was seen that there had been 6° of frost in the night; the wind became south-east, and frost abated. On the 20th—the equinoctial day—the wind was north; the thermometer had been 31°, it rose to 40°, declined at night to 30°, and to 24° (8° of frost) before sunrise of the 21st. It was seen that the wind had veered to *south-west*, whence it blew very forcible, the temperature rising fast to 44°, and the sky becoming entirely overcast. *Thus, then, the direct prognostic, up to the very period of the sun's ingress into Aries, was favourable, promising a calm and dry summer.* But it was rendered doubtful by the change which took place at the critical juncture; for not only had a complete southerly brisk current been established, but the barometer, which had been gradually falling after the 14th day, rose from 29.65 to 29.67 on the 21st.

Thus an equinoctial change was produced, and the usual criterion was rendered ambiguous. On the 22d, the barometer fell to

29 in. 20 cts.; rain fell, and was repeated daily, sometimes with hail, and with south and westerly brisk winds. The three last days of March were fine—wind very fluctuating—barometer the same.

As, therefore, there were two distinct indications, one, according to the rule, affording sign of a fine and dry summer, weakened, however, by a depressed state of the mercury, and the inauspicious attack of the severest frost of the whole winter; the other manifesting a sudden change of atmospheric condition, we are constrained to admit that the equinoxes must not be relied on as unerring indices of the general weather of summer and winter. In the instance before us, it is certain that the latter manifestation predominated; for not only did the wind change at the exact period, from northerly to south-west, but it blew with violence, and introduced much rain in March.

April approached wet, and with nearly the warmest temperature of the month—43° at night, 56° *max.*, 48° at 10 p.m. Rain fell during nine successive days, more or less; of these eight were cloudy. The 9th had sun, and the 10th day was fine, with wind at south-west. Again, five days were rainy; the 16th fine, wind north-east—warm—48°, 58°, 49°. Subsequently, there were seven days with showers, and as many dry, with more sun. Thus twenty days of the thirty were wet. There was thunder on the 25th, and throughout the whole month the wind fluctuated very much. The average minimum of the night was very nearly 40½°, the maximum 33°.27. The estimated averages are 29° lowest, 74° highest—mean, 49°.9. We had no such extremes, the days and nights being far more equable, and so they continued to be throughout the summer, a circumstance much to be noted. The highest temperature with me was 60° on the 12th; the lowest, for an hour or two early, was 32° on the 27th day.

If, however, the equinox produced only a period of rain during the four or five succeeding weeks, another curious phenomenon was remarked about the middle of April, which excited the attention of many, and was publicly noticed, as a precursor of a warm summer. As I have alluded to this before, it will be as well not to bestow many words upon it here, otherwise than to refer again to Mr Sturgeon's observation concerning the opposite electrical conditions of the oak and ash-trees. I cannot understand by what means this opposed condition has been ascertained; but, admitting the fact, for the sake of argument, I would suggest that, as whenever an electric current passes through a conducting body, (or to speak more philosophically—*polarises* each individual atom of which it is composed,) a *magnetic* spiral current is induced; so, whenever a magnetic polarising current passes through a conducting medium, an electric current may be presumed to flow spirally round the magnetic conductor.

If, then, we admit the *oak* to be primarily excited by *electricity*, and the *ash* by *magnetism*, assuming, at the same time, that the former fluid is a *heat*-producing agent, and the latter a generator of *cold*, then we may obtain something like a rational interpretation of the opposite condition of the two trees.

Thus, then, the early sprouting of the oak-spray, long, perhaps weeks in advance of the ash, (a condition observed by numbers in 1844 and 1846,) is to be regarded as a prognostic of a warm summer. On the contrary, the ash being in advance, affords a contrary indication. I have been assured that, in 1845, the ash preceded the oak; and it cannot be doubted that, with the exception of a week or two in June, the summer was wet and ungenial. If electricity be always productive of magnetism, and, *vice versa*, if magnetic action produce electricity, I cannot conceive how it would be unphilosophical to ascribe the phenomena of heat and cold to these two ethereal agents. The rain decreased after the 22d of April; still, showers were frequent, and the temperature was not genial, though we had sun in the last week.

MAY, however, came in fine, and from the 2d till the 12th day, our mid-day heat was 60° to 66°, wind generally west or south; night, 48° to 54°, and with plenty of sun by day. On the 16th, the wind veered to north-east, the current being forcible and cold. The weather was fickle, showery, and threatening; 17th, drizzling rain after starchy, cirro-stratus (mackerel) clouds. 18th, very showery; 19th, the same, with alternating gleams. Barometer began to rise from 29 in. 46 cents.; it fluctuated on the 20th, but its rise was decisive and confirmed on the 21st; and here we date the close of our doubtful prognostic, and, in fact, of the agricultural spring.

The averages of the last month were—Barometer rarely 30 inches during the thirty days, excepting from April 29th to May 3d it fluctuated between 29 in. 10 cent., and 29.97. The thermometer—lowest 44°—maximum by day, 58° 43′.

If it were possible that the 21st of June could rationally be considered the first day of summer, (*i e.* three days only before the 24th, which we choose to call *mid*-summer day,) this year would furnish an exception; for, *on the 21st of May*, the barometer having risen by ten o'clock at night to 29 in. 98 cent., the wind east by north, after a cool cloudy morning, at 41°, the sun broke forth from the clouds about ten o'clock, dispersed them, and introduced that month of splendour, which appears to have had no recorded precedent. My diary, now before me, registers the term "cloudy" but twice at eight in the morning; namely, on the 23d of May, and on the 10th of June; and twice at 2 p.m. on the 10th and 11th of June! The temperature at two o'clock

of the 22d rose to 76°; on the 31st it was 80°; June 3, 80°; thence rising daily, till on 6th and 7th I observed 92°. The heat was then oppressive; the evening of the 7th cloudy, with a hint of rain. There had been thunder in the west. A slight disturbance in atmospheric electricity had taken place about this time, and here it was manifested by a cloudy sky for half a day on the 9th, and the whole of the 10th; but it passed away, and from the 11th to the 15th inclusive, the sky was almost cloudless. The wind was east from the 13th to the 18th, with very great mid-day heat—82° to 85°. On the 19th the wind fluctuated from east to south-west, west by north, a misty haze recurring early, threatening thunder; the wind, however, became gusty on the 20th, from north-north-east.

During these thirty-one days the barometer was high, several cents. above 30 inches, excepting on May 21, June 8, 9, and 10; and even then it was only a few cents. below 30 inches. The average temperature of all the days at its maximum was above 77°, the night temperature about 55°—very equable after the 21st May.

It was remarked, that the wind was fresh and lively generally till sunset, when it subsided to perfect calm, or balmy softness. The excess of heat at so early a season did injury to every species of crop, excepting the grass and clover, which, having become exceedingly thick on the ground, in consequence of the April rains, were now brought with great rapidity under the scythe, and placed in rick in the shortest possible time.

As every peculiarity of a season so extraordinary is worthy of disclosure, I observe that the frost of March 18—21, had destroyed nearly all the precocious blossom of pear and plum trees; hence none of their fruit set. However, as April proved so wet, and May and June so greatly warmer than customary, a second series of bloom formed on many trees, which proved prolific. On a standard *Marie Louise* pear, which had borne more or less fruit for three seasons past, nearly 30 pears set, all upon the extreme ends of very long extended spurs; this crop has ripened; and though the pears are not more than half their size, the flavour is very good, nor are they many days later than ordinary. I have other trees with some fruit. As to vines, the sweetwater, muscadine, and black Frontignan, were so very early and fine in July, that I thinned the clusters; and some produced berries large as bullaces, far richer in flavour than fruit grown under glass, which, strange to say, has not coloured well—the Hamburg particularly. The *claret* grape ripened its clusters so well on the south-east wall, that I made wine from them in September.

JUNE 21 *to July* 21.—I consider this period to be the second

month of agricultural summer. Of the last ten days of June my diary notes—22d at 58°, 82°—72°; wind, east to south-west; sultry, electrical clouds in the evening. 23d—Thunder at dawn—the first refreshing shower. 24th—Gloomy and cool; 58°—64°. 25th—Showery, heavy thunder at 2 p.m. 26th, 27th, 28th — Occasional slight showers. 29th, 30th — Showers at times; generally sunny. The whole of the last week, cold—62° to 68° maximum. Barometer fell rapidly to 29.50 cents on the 25th, it then rose progressively, till, on the 30th, the mercury stood at 30 inches.

July is admitted to be the showery season of our British climate, and during a wet season it becomes a truly weeping month—a prognostic of evil to come.

In order to convey a tolerably correct idea of the weather in the midland counties of England, I appeal to my diary; the extracts from which may enable the reader to compare notes with the details given at page 489 of this Journal. There we read, that in "the end of June storms of great intensity occurred, followed on one occasion by a rain of thirty-six hours' duration—that the land was saturated," and, till the middle of August, "the weather may be characterised as *wet* and *unwholesome*."

With us July came in with low temperature—52°, 64° max.; 59° at night; wind, south-west, brisk—cloudy sky. 2d—Rain in the night. 3d—Overcast early, brilliant day; 70° max. 4th—Foggy morning, then fine and hot—81°. 5th—*Thunder* after oppressive heat. "*This day or the 6th has of late years been noted for a storm.*" 6th—Showers and wind—south-west to west. 7th—Fine. 8th, 9th, 10th—Some showers, but no *ground rain* with us; the soil is still *dust dry* at the depth of *three* inches. 11th—Heat begins to return with powerful sun. 12th—Fine. 13th—Wind wavering, currents in all directions. 14th—Oppressive; 85° max., with some thunder, which cleared the air—scarcely any rain. 15th—Fine. 16th—Changeable—brisk south-west wind. 17th—Strong currents—wild black clouds. 18th—Fierce wind, south-west—one shower. 19th, 20th—Finer; west wind; summer-heat. 21st—Scuds of rain, but still the "*ground dry;*" and thus, with greatly reduced average temperature, tantalizing clouds, and perpetual meteoric alternations, we had no penetrating rain whatsoever. The average of temperature, during this second month of summer, was—by night, 55°.129; maximum, 70°.9; mean, 63°. July 22d, 23d, were fine days—warm day and night. 24th brought a nice rain; the sun set crimson red. 25th—Two showers—otherwise fine. 26th—Beautiful. 27th—Pretty fine, but changeable; so far the wind was westerly; but, on the 28th, it fluctuated at every

point, then went to the east. 29th—East by south—85° max., night, 66°. 30th—North-east, 83°—69°. 31st — East-north-east, 65°, 85°, 69°. These three last days, though fine and hot, were rendered cheerful by air, which became electrical on the 31st, when there was evening lightning. The barometer from the 25th to the 31st, inclusive, stood from 30 inches to 30.27 cents.

The effects of the summer to this date upon agriculture and its crops, may be understood by the following observations made at the time:—

"The extreme and dry heat brought the corn forward rapidly; insomuch that the wheat was harvested with us, to a very great extent, before the end of July, in the finest condition; though some farmers found fault with its quality. The oats were very short, miserable-looking things; droughted, half-grown, irregular; the barley better; but, like all checked vegetation, it was debilitated."

The rains were lost upon both, the mischief having been previously done. *Clovers* yielded admirably—a second cutting after the first heavy one; but turnips were wretched, the beetle (*haltica*) having, in many cases, devoured two or three sowings. These remarks extended to the third week of August, which period I must now introduce.

August 1.—A day never to be forgotten in the parts east of this most favoured spot. My diary notices it thus—"Highly electric, heavy, varying clouds; thunder and sharp rain for three hours — hail. The barometer at 29 in. 80. Thermometer, early, 64°, then 86° at its highest degree; wind every way. Viewing, as I did, the flashes of lightning at almost every second, and a continuous rolling peal in the south-east, I conceived that the storm was heavy along the range of the Buckinghamshire hills, which extend along the Thames, between that county and Berkshire. We had a heavy, or rather a close rain, and a little hail; but entertained no suspicion of the ravages which were perpetrated even at Slough, (six miles off,) and thence, through Middlesex, to London. In the metropolis, the desolation was frightful. Sewers exploded, streets converted into rivers, and glass broken to an extent that did not admit of complete repair for three weeks. A military man, who had been in all climates, assured a friend that no storm in the tropics, that he had witnessed, equalled in violence the one which occurred in London on the first day of August."

2d—Fine rain till noon. 3d—Rainy morning, two thunder-showers, heavy rain. 4th—Small rain. 5th—Thunder at intervals, from six till noon; red suffusion at sunset. 6th, 7th—Oppressive and damp. Some thunder on 6th. Profuse rain also on [illegible]th. From 9th to 13th, a gloomy period with a high barometer.

14th to 18th, finer, with sun, then much rain. Changeable to 20th; that day quite cloudy. During this monthly period, the winds for twenty-one days were westerly, fresh; the barometer rather high—average nearly 30 inches. Thermometric averages, lowest 56°, maximum of the days 77°—83°. *Another change*, (a curious coincidence!) again on the 21st, for then the barometer rose to 30 inches, and, excepting about twelve hours on the night of August 28th, retained or advanced beyond that point till September 6th. The wind north-easterly, ten days; the thermometer rising from 70°, (with a few recessions,) till the 31st, when its highest degree was 77°, night 60°. My remarks were—"August 21—Weather more settled. This day (26th) the air and temperature have been exquisite. 27th—Heat increases. 28th—Curious modification of clouds; changeable increase of heat. 29th—A slight shower, and faint rainbow. 30th—Very fine. 31st—Misty; followed by great heat till evening."

September was consistently fine, with wind at north to north-east; heat increasing from 67° to 81° F. till the 7th day. Then, with very fluctuating wind, the morning was hazy, and a thunder-storm of very singular character visited this neighbourhood. The lightning was exceedingly vivid, coloured, and recurring at short, but regular intervals, followed by grand peals of thunder, all of which appeared to be equally distant, as I counted about twelve seconds between the flashes and the reports. The storm lasted about two hours, till five o'clock in the afternoon, and brought the first *thoroughly soaking* rain of the season. The air had been oppressively electrical, heat 7°; but it cooled twenty degrees before night, and on the 8th day fine weather was again established, with north-east wind, till the 15th day. The glass then began to fall; the wind went north by west to westerly on the 17th; to south-east and north-east on the 18th and 19th. The heat had been high during four of these days; but with 76° on the 17th, this summer temperature bade us farewell. The averages to the 18th inclusive, were 77° maximum. Minimum of all the nights, 52°.6. The barometer continued to recede till it reached 30 inches on the night of the 18th; it subsequently fell to 29.55 on the 22d. We now approached the *autumnal equinox*. September had been a most lovely season till the change of wind above alluded to, the current then became brisk and unsteady; it was strong at east on the 21st, the sky being then overcast, and on the south-east coast a few slight showers fell. On the 23d—the sun entering *Libra* about 10 before noon of mean time—a total change of wind to south-west occurred, and rain was established: thus, then, we have another

equinoctial change, and the fine weather passed entirely away, excepting on the two last days of the month, which were clear and cool.

I have now gone through the summer months, which, in the present year, have certainly been four in number; for there has not been above thirty days during the whole period included between May 22d and September 20th, wherein the thermometer did not mark some degree above 70°, and thence upwards to 80°, 85° and 90°; and when below 70° the figure was 67° generally.

October proved a complete reversal of the genial character of its predecessors, and thereby nullified the old, but prevailing opinion, that twenty of its days are fine. I shall now enter into some detail of its course.

The 1st, 3d, 4th, and 5th days, the 16th beautiful, mid-day heat 63°; all the others, to the 22d inclusive, were wet—profusely so in many instances. Thus the subsoil, which in this dry quarter of Berkshire, resting generally upon strata of chalk and gravel, was penetrated, and the surface earth in so drenched and saturated a condition, as to prove an obstacle to wheat-sowing. Herein we have another decisive proof of the absence of any thing like thorough draining. Our farmers seem generally obtuse upon this point, you never hear it alluded to; yet, I verily believe, that not one acre in a hundred is drained at all, nor any one, upon whatever subsoil the ground reposes, above half the required depth. There is no serious impression—no urgency upon the subject.

On the 21st—again that date!—the barometer *then* reduced to 29 inches, began to rise; on the 23d it stood at 29 in. 80 cents, —temperature reduced to 58°—sunny—a fall of the mercury, with rain in the night. A decisive rise subsequently took place, which, at the end of October, brought the mercury to 30 in. 14 cents. The weather was fine on the 25th—it then became consistently foggy, to an extent remarked as very unusual at that period of the year. The averages of the month were—lowest, 46°.5, highest, 56°.3 Fah.

November—the concluding portion of the agricultural autumn —has justified its original character for fogginess and gloom. The barometer began to fall in the evening of October 31st, and, in the twenty-four succeeding hours, had reached 30 inches; the wind above and below crossed, namely, south-east south-west. There was some rain after fog, then sunny gleams; temperature, 37° to 45°. The upper current prevailed, and the wind was south-west till the fourth evening; a very little rain fell. The 4th, oppressively warm—46°, 60°, 50°—haze early—fine subsequently. On the 5th, with wind changed to east, though then

calm, there was haze or fog till evening. 6th to 9th.—Gloom and haze—no gleam of sun, but on two occasions since October 26th, and then only for a few hours. The mercury rose during this foggy period to 30 in. 44 cents. On the 10th a brisk north-east breeze swept away the fog, but left a covering of clouds. Still the ground dried apace; and since the cessation of daily rains, wheat-sowing was effected auspiciously.

The 11th day is worthy of being chronicled as a specimen of autumnal splendour. The air brisk from north-east, yet balmy —lowest temperature of the night above 40°; sun glorious—shade temperature, 52°—sunset affording the most exquisite suffused tints of orange and crimson, above and round the horizon. The tintings also of the trees were peculiar; for as previously there had been no frost sufficient to affect even the scarlet runner beans, the oak, beech, and elm trees still retained their proper colouring; hence, the effect of the rich sky upon our noble screens and on wooded eminences, was enchantingly fine. The plough, too, had now found a thoroughly good tilth, so drying was the air.

The equability of the temperature since the departure of fog on the afternoon of November 8th, was remarkable. The barometer retained its height, 30.32 cents, as a mean. The thermometer, by day, varying from 46° to 50°; wind very brisk, from east by north; sky gloomy and overcast. The mean temperature of the second week, as stated in the *Gardener's Chronicle*, was at Chiswick—maximum, 47°, minimum, 39°.4, mean, 42°.3. I find, by regular comparison, that locality to vary in its extremes considerably, from those of our open, and rather elevated common. They are almost always rather warmer by night and cooler at the mid-day observations.

I am now arrived at a point when I may assume the present tense in the few remaining remarks; and on this 15th day, with the same meteoric conditions, though there has been a fall of a few cents in the barometer since its greatest altitude, (30 in. 44,) on the 10th, I must state that, so propitious has been the seed-time, that wheat sowing has been furthered almost, if not entirely, to its completion. At the same time, the alarm of famine, which it has been thought fit to proclaim throughout the land, appears to have subsided. It is unquestionably true that oats, barley, and beans, must have been scanty in return; the dry season, at so early a period, determined their fate; but in all other crops the supply is ample, and prices recede. The artifices of self-interested dealers gain success for a time; but in the long run truth is discovered, and prevails.

Potatoes are short of crop in the south, because the young tubers were droughted; but, as to disease, its character at least

is altered; and, as I have felt it a duty to state on several occasions, it now passes current as a confirmed fact, that the total destruction of *the haulm* has proved no certain indication of infection *in the tubers*. I have judged it prudent to plant all my winter stock in October, in order to make a change in the condition of the tubers, but not at all with any view to accelerate the ripening of the crop. Experience taught me the diseased sets planted in November did not extend disease, and, at the same time, that nothing was gained in point of time; the present attempt, therefore, is purely experimental; the soil was new, and received no common manure. Over the sets, when deposited, 9 or 10 inches asunder, in six-inch deep drills, 30 inches apart, was scattered a mere dusting of old deal sawdust, mixed with a third of coal and wood ashes, and about a peck of coal soot to three barrows of the other materials.

After November 11th the weather became cold, dark, drying, with a very brisk wind from east by north, and so remained till the 15th, the glass falling from 30.30 cents, to 30.16 cents; the wind became east. On the 16th it was south by west; and on the 17th there was some drizzling rain, the mid-day temperature rising from 45° to 52°. The sun broke forth on the 18th, with temperature 55°, and there were alternations of brisk showers, the clouds breaking up into cumulous masses, a form which has not been assumed for several weeks.

New moon occurs this night at eleven o'clock; we have still to ascertain whether the lunar phases produce any effect on the weather. It, however, is more than probable that a body so large and near, must exercise some reciprocating electro-magnetic power with our planet.

The weather, to the day when I am constrained to close this article, continued showery, with very fine sun during the intervals. The atmospheric pressure diminishing to 29 in. 80 cents.

The last month of autumn is now within a day of its completion, and, with it, the agricultural year, according to the position which I have assumed. As a closer to these characteristics, which have afforded evidences of extraordinary meteoric action, it is gratifying to report the termination of one of the finest wheat seasons that I have ever witnessed or reported. The dry weather, and brisk winds of November, brought the ground into fine condition, and no time was lost. The staple had been deeply and thoroughly heated; the protracted rains of October following immediately; and now the seed has germinated, showing the braird fine and healthy.

There has been no frost—my own observations assure me of this, and a letter from Hertford, just come to hand, saying that the *heliotropes*, dahlias, and the like which always succumb under

the slightest attack, remain in security. My geraniums and fuchsias are in bloom, and several other tender plants. Are we to look for another fine season?

On the Potato Disease, (continued from p. 355.) By P. F. H. Fromberg, First Assistant in the Laboratory of the Agricultural Chemistry Association of Scotland.—According to what I proposed myself to do, I shall, in this paper, first give a brief extract of some experiments made by Professor Vrolik in Amsterdam, and communicated by him in a separate form—and further proceed to offer some physiological remarks which may be found to bear upon the subject. I may add here, that the recurrence of the disease, which has now been converted into a most lamentable certainty, does not tend to disprove the views which I last year was compelled gradually to assume.

Professor Vrolik's experiments chiefly tend to show, that even diseased tubers, planted in the soil in which they got the disease last year, will produce perfectly sound plants, and full grown, ripe tubers. His experiments are the following:—

In the first place he tried to grow winter potatoes, a practice which is not followed in the Netherlands. At the same time he had in view to ascertain the influence of liming the cuttings before planting them, and that of the soil in which diseased potatoes had been growing.

He found that this winter culture did not succeed well, the growth being weak and stunted, which he ascribes to the coarseness of the kinds he used, and the frequent breaking off the shoot. He obtained, nevertheless, from his seed planted about the middle of September, a number of small-sized and completely sound potatoes, and not the slightest difference could be seen between those from a diseased soil that were limed, and the unlimed ones from pure land. They were planted partly in a garden, partly in land where Swedish turnips had been grown before, and partly in an orchard. The distance between the sets was eighteen inches, and the depth varied from about nine to twelve inches.

Being not contented with this defective result, he instituted another experiment with four varieties of diseased potatoes, among which was one known in this country by the name of early kidney. One half of the whole lot was planted in the same soil in which they had been growing, or so called diseased soil, the other half in fertile and perfectly sound land. He had, therefore, samples of each variety growing in two different conditions. Perfectly healthy potatoes were also planted, partly in affected partly in healthy soil, with a view of ascertaining how long it would take to make them commence sprouting,

and what would be their properties after having commenced to sprout.

The diseased tubers, which were sprouting before they were planted, continued to grow regularly, passing through all the stages of growth. The sound ones were four months in the soil before they gave any signs of vegetation; but after that they grew vigorously, and not the slightest difference could be perceived between those growing in the pure and those in the (so called) affected soil.

The plants from the diseased tubers, gave signs of natural death after three and a half months, and therefore they may be considered as having employed the usual period. The tubers produced by these affected sets, were *all*, without exception, *perfectly* sound, and of the best taste. They differed in size according to the variety from which they were obtained; but samples shown at a meeting of the Royal Institution of the Netherlands, taken from the flower-pots in the presence of the members, exceeded the expectation as regards their size. One of the varieties, both that in diseased and in pure soil, had produced tubers with little warts alternating with cavities on their exterior; but this is a cutaneous disease, commencing in the epidermis, and only proceeding to a very limited depth into the interior—this variety is notorious for being every year, more or less, affected by this disease.

Upon the strength of these experiments, Professor Vrolik assumes as his opinion, that the planting of pure and sound sets in sound land, although by no means to be looked upon with indifference, is, however, not necessary to obtain a sound crop.

Thus far Professor Vrolik. His opinion, expressed in the same page, that the recurrence of the disease this year, if at all probable, was not likely to become equally disastrous and extensive, has been realized with regard to Holland, but, unfortunately, not with regard to Great Britain. In this he has been, equally with others, contradicted by the state of the crop of this year. But this cannot, by any means, be laid upon them as a charge, any more than those who last year, from some reason or other, (not supported by physiological evidence,) pronounced the potato 'rop as *doomed*, are to be considered as having hit the truth by neir ingenuity.

Before proceeding any further with stating and collecting a few physiological principles that bear upon this subject, I may be permitted to offer a few remarks upon the native country of the potato.

Whoever may have been the first importer of this plant into Europe, either Sir Walter Raleigh or Sir Francis Drake, or any other who is named with more or less probability, it appears to be

beyond doubt, that the potato is a native of South America, that it is still found growing wild in the Cordilleras, and that in addition to Peru and Chili, perhaps also Mexico may be named as its native country; although Humboldt and Bonpland assert, that in the latter country the potato does not grow wild, being introduced from the mountainous districts of Peru.

The climate and productiveness of Peru are very variable. The western part, between the Andes and the Pacific Ocean, is nearly one arid desert or sandy zone, without almost any vegetation. On approaching towards the Andes, both the supply of water and vegetation increase. This part is called High Peru. Every climate and almost every kind of vegetation is there met with, until the height of 11,000 feet above the level of the sea, which is at the line of perpetual snow. The elevated valleys between the Andes are very fertile, and the climate is temperate. But by far the greatest and most beautiful and fertile part of Peru is situated on the east side of the Andes. In point of climate and of beauty, luxuriance and variety of vegetation, this part is surpassed by none in the world. A multitude of rivers intersect this almost smooth table land in every direction. The maxima and minima of temperature, the sun being in zenith, have been found to be 85° and 75° Fahr. Vanilla, indigo, and an endless variety of the finest fruits and vegetables grow here in the natural state, and among the latter is the highly interesting potato. Huanaco, a valley at an elevation of 6300 feet, is the most prominent, in every respect, of this fertile part of Peru.

Chili, a narrow strip on the west declivity of the Cordilleras, may be called, *as a whole*, the most favoured country of the New World in every respect, and particularly by the beauty and variety of its vegetation. Its climate does not essentially differ from that of the most fertile part of Peru, just mentioned, to which it scarcely yields in the abundance and luxuriance of its vegetable products.

Mexico, which is situated to the north, presents such a difference in its climate and productions, that no general description can be given. Suffice it to say, that more than two-thirds of its surface are situated in the temperate region, and that its rivers are of little importance, although the number of lakes is considerable. The most sudden changes of temperature and also of vegetation are not uncommon, owing to the very variable altitude. In the immense high land, on the declivity of the Cordilleras, the temperature is more equal, and an almost uniform spring heat prevails there. Wherever the potato is cultivated in Mexico, it is invariably in mountainous regions.

After this brief glance upon the native country of our plant, we may go on to make some additional remarks. We proceed from

the principle, that every plant grows naturally there, where soil, average temperature, and climate, are most favourable to it; or rather, that where we find any plant growing wild, we may infer, that there every external circumstance co-operates to make it thrive without artificial means. When, therefore, an attempt is made to transfer a plant to some other place with a view of cultivating it, it will thrive so much the better the more the new abode approaches in its natural conditions to the native country itself. Any deviation from the normal state, in the new region, will tell upon the appearance and properties of the produce, which is now no longer a purely natural one. The greater these deviations are, the more the difference is in the requisites essential for the growth of the plant, the more serious will be the influence upon the state of the plant itself.

It is the task of the art of culture to make up, as much as possible, for any such deviations. But as the greater part of the external circumstances, by which the growth of a plant is regulated, are beyond human control, it can only be by equivalents, or supposed equivalents, that we can try to make up for natural deficiencies; that is, when the temperature or duration of the seasons do not admit of a plant being brought to maturity in its natural period, we apply manures of some kind, we stir the soil frequently, to make it throughout better accessible to the air, to make its particles more readily disintegrate, and so to yield a more abundant supply of food, by which the plant is considered to become capable of growing more in a given time, and to endure a less favourable climate with a certain degree of impunity.

A plant, therefore, can, in our opinion, never become entirely acclimatized, and will always be in want of artificial means to resist in some degree the influences of circumstances foreign to its proper nature. But will it be possible at all so to compensate for this deficiency of certain conditions, by the introduction, or rather by the overcharge of others? Is it in accordance with the laws of nature, that conditions of an entirely different kind can replace each other so effectually, that the healthy growth of the individual is not at all impaired? And if the unfavourable consequences of such an abnormal state of things, of such a totally artificial culture, be not visible at once, what warrants us to imagine, that the organism of the plant and its functions will remain unaffected and act regularly during a long series of years? Plants are living beings, as well as animals, and however little is as yet understood of their vital functions, of this we are tolerably certain, that they, as well as animals, are subject to certain regular laws, and that any deviation from those laws will not be wanting of its peculiar consequences, which will be in proportion to the degree of that deviation.

Keeping this in view, we will naturally ask, can it be that the increase of the food of a plant will compensate for the decrease of external temperature? Can it be that an excess of nutritive matters will so strengthen the constitution of a plant, that it will bear without disadvantage the influence of a colder or more variable climate, than its parent in its native country was accustomed to experience. We know that in the animal kingdom there is a law, according to which a degenerated offspring from a nobler parent will be content with less advantageous food or climate, that in fact the degree of degeneration will bear some relation to the manner of living required, and that no other serious consequences will ensue.

It is also asserted by some—although we are far from unconditionally subscribing to the assertion—that an animal, when living in a cold climate, will take so much more food, as will, by a so-styled combustion, produce an increase of animal heat adequate to the decrease of the external temperature.

But this presumed analogy between the animal and vegetable kingdom has too frequently been extended beyond its proper limits, so as we would feel inclined to reason upon it as on safe ground. Without saying any thing more, we would only draw attention to our yet most defective knowledge of the functions of plants, and who will think it reasonable to assert, that in an almost unknown world something takes place in a certain manner, because it thus happens in one that is better known?

But let me inquire what is, according to our present knowledge, the influence of soil, climate, and temperature, upon the development of a plant, and how, on the other hand, are we to understand the manner in which that development is brought about by the act of increased nutrition?

The influence of a soil upon the growth of a plant is twofold, either chemical or physical. Its chemical influence consists in the containing of a certain proportion of various organic and inorganic substances, which the plant requires for its growth, and which, after having been dissolved by the liquids in the soil, are taken up by the roots; no doubt after these substances have previously formed certain mutual combinations, which are successively again decomposed within the plants; for it is, in our opinion, chiefly on the elementary substances being in a nascent state, that their action in assisting the vital functions of the plant depends.

What we mean by *physical influence* is not less clear; it means the structure of the soil, as affording by its degree of porosity a more or less easy entrance to the roots, and at the same time varying in its power of retaining moisture, and of giving free admission to the atmospheric air. The development of the roots

of a plant will be freer, the greater the number of pores in the soil, and the more moveable the particles are that come in their way. But we would particularly draw attention to the influence of the soil *as a whole* upon the form and nature of the parts that are placed in it. It is a well-known fact, that when, under certain precautions, a tree is inverted with its leaves and branches into the soil, and its roots and rootlets into the air, the former will be converted into the latter, and *vice versa*. If we bear in mind, that it is one of the characteristic properties of the roots, that they emit their fibrils from *any* point, and not from fixed points or buds, as is the case with the branches and leaves, we will see that the soil has exercised here a very material influence. By its agency, the regularity of the places where the roots of the branches (leaves) are produced, has become deranged, and any point of the modified branches becomes capable of producing fibrils.

To understand the importance of this change, it may be necessary here to remark, that the branches, like the stem itself, have all a medullary canal with the medulla enclosed in it, and that from this canal vessels proceed towards each fixed point or bud, from which leaves are to be produced. This canal is wanting in far the greater part of roots, and the regularity of the arrangement of the different layers, so striking in stem and branches, is not to be found here; and hence may arise, that from any part, possibly owing to the presence on that spot of a greater supply of food in a state of decomposition, new shoots can be produced. From this we see, that in the cases here stated, the soil must have actually been operative—changing the structure of the branches, and at the same time, that the roots, placed beyond the influence of the soil, must have undergone an equally important change.

This influence of the medium in which the part of a plant is placed, is no less perceptible in the formation and structure of a tuber, such as the potato is. A tuber is nothing else than a subterraneous bud having all the essential parts of a bud above ground, and therefore of a stem also, with some modifications as to the state of development of the several parts. But we seldom or never find in a tuber that regularity of the different layers and external form, which a common bud exhibits. The so-called eyes or germs into which the vessels terminate, are almost all arranged towards one extremity, and very frequently not the slightest regularity can be perceived in the form of the whole tuber. Internally, the part corresponding to the bark of a stem, but very much increased in thickness, consists of a highly developed cellular tissue, greatly impregnated with moisture, and in the case of the potato, repleted with globules of starch. The liquid part contains, besides other substances, a certain propor-

tion of soluble protein compounds, or albuminous matter, but a considerable quantity is also deposited in an insoluble state in the cellular tissue, and mixed up with the incrusting matters of the cell-walls. In the centre of the potato we find the part corresponding to the pith of a stem, also consisting of cells, which are filled with globules of starch. This central part is produced by the enlargement of the pith of the shoot, around which there seems to take place a gradual production of additional cellular tissue. The ring of spiral bundles, which are placed around the pith, being analogous with the woody ring of a stem, yields to this successive enlargement, and is at last converted into a more or less circular enclosure. Here also, as is the case with roots, new tubers seem to be brought into existence by a peculiar condition of such parts of the soil with which the shoots are in immediate contact. This might be effected by a large amount of decomposing organic matter, which communicates its own condition to the protein compounds in the shoots, though modified by the organized state of the latter, renders them first of all more soluble, and then causes them, along with dextrin, for a time, to circulate more rapidly. This impulse (so to speak) having ceased, part of the dextrin consolidates into little membranaceous bags or cells, upon which a layer of consolidated albumen is almost simultaneously deposited, whilst another part is held soluble by the incessant action of the organic matter in the soil, which continually enters the roots, to be there converted or remodelled into the same nitrogenous and non-nitrogenous substances that are present and active in the living shoots. This process has some analogy with fermentation, although in other respects it differs from the latter, both in its products and in the conditions necessary to call them into existence.

The shoots themselves have, in every respect, the same structure as the stem above the ground, only differing by their respective degrees of development. In a true stem there exists, between the medullary canal and the bark, a number of greatly developed wooden rings, which chiefly consist of elongated cells, entirely different in form from the cells of a tuber. We find here, however, no liquid part; the quantity of protein compounds, deposited upon the cell-walls, is but very small, and starch is only present in small quantities at a certain period of the year, viz. about winter time, and limited to a certain part of the stem, viz. the medullary rays. It will further strike us, whilst the woody tissue is the preponderating part of a stem—the bark being in general but little developed—the latter, on the other hand, increases in the potato tuber to a comparatively enormous extent, whilst that of the woody rings remains insignificant.

There is another well-known fact which shows the great influ-

ence of the soil upon the structure and products of a plant, we mean the earthing up; a practice which is frequently applied to potatoes, and the effect of which is the extraction—if I may call it so—of shoots and tubers from a part of the stem, which, when above ground, produced neither the one nor the other. It is probable that the moisture and the decaying organic matter of the soil have a great deal to do with these peculiar actions.

The influence of climate and temperature, which we may class together, is chiefly operative upon the motion of saps in the plant. Whatever the cause of that motion may be, (for endosmose and exosmose are only names for designating a phenomenon which is itself still unexplained,) we know that it is accelerated by the action of the sun; for it is, to a great extent, an effect of this action that in spring the young parts of plants are developed, nutritive parts having first been dissolved, and being then conveyed and diffused throughout the plant. As the rapidity of that motion is determined mainly by the temperatnre of the air, so is its regularity influenced by the climate, and the length and succession of the different seasons. Upon this regularity the gradual development of the several parts, in due succession and proportion, mainly depends.

If we now look at the effect, with an increased quantity of food produced within the plant, it will strike us, that this is of a different nature. As the kind of soil influences the quality of the substances that are taken up, and the development of the parts placed in it, and the climate and temperature act upon the regularity and rapidity of the motion of the sap—so an increased quantity of food within a certain space, in the shape of manure, will change the density of the liquid in the soil, and there can be little doubt, that this change must seriously affect the thin membranes at the extremities of the roots, through which these liquids have to pass. If the opinion of a great chemist and physiologist of the present day be correct, viz. that the various proportions in which different substances in the soil are taken up by the roots of different plants, are caused by the said membrane having in different plants a different power of transmission for the same, and in the same plants for different substances—then we could understand so much of the effect of too concentrated solutions of food existing in the soil by the admixture of manures, so as to produce by reiterated occurrences an entirely abnormal state of these highly important and characteristic membranes, by which the extremities of the tender roots are closed. Whether the food has been too concentrated generally, or overloaded with one or two peculiar ingredients—both would tend very much to produce the same effect.

Be this as it may, we think it not an ill-founded opinion, that

the application of a nutritive liquid of greater strength and density, so far from counterbalancing the deficiencies of other kinds, will more and more derange the normal functions peculiar to the potato in our case, and thus gradually render it less able to withstand the variations of climate and temperature. It is not in accordance with physiological principles, that anomaly of one kind can be rendered harmless by some other anomaly: the two or three together will rather co-operate to change the nature of the plant more and more. The so-called improved methods of cultivation may, and actually have to some extent, increased the produce of the potatoe amazingly, and in this manner both the wants of the increasing population and of increasing avidity have been fulfilled; but the history of the various and frequently returning diseases of this valuable plant every where, and in almost every kind of soil and climate where cultivated, tells us plainly that the laws of nature cannot be transgressed with impunity, whilst the present disease, probably prepared by various lighter forms, appears as a last seal upon the sentence of nature.

We may now be permitted to approach a point which is attended with various difficulties, and which may resemble a kind of criticism of the various opinions that have been offered as to the cause of the present disease. We shall, however, only touch upon one or two general points, and will offer our remarks as they arose in our mind after reading and considering these opinions.

The first impression was a general conviction of the weakness of the foundations of our present physiological knowledge of plants, derived from the ambiguity with which several arguments of various theories have been proposed. In fact, we were told by some defenders of direct atmospheric influence, that it was merely a decrease in the temperature about the time of ripening of the tuber, by which this mysterious disease was caused. Now, this year it has returned at a much earlier period. Has the time of ripening been hastened; and if so, by what cause? And is there any evidence of such a decrease in temperature having taken place this year? Besides, did such a decrease exist last year every where? Other defenders of the same theory assume, that it was the sudden change of wet and cold to hot weather by which this calamity was occasioned; and others state, in addition, that the unripe condition of the seed from the former year, and the protracted cold of the ensuing winter, preventing the due preparation of the land, were either the aggravating or the chief causes of the disease. Have these circumstances occurred this year, and have they been general, wherever the disease has prevailed, or prevails at present? If we further come

to the manner in which this atmospheric influence is said to have acted, then we meet again several vague expressions, and find that unproved things are taken for granted. Some speak of the organism of the potato having become repleted with moisture, and, therefore, the pores being checked by some of the above circumstances, exceedingly liable to undergo putrefaction. Others are of opinion, that one constituent of the organism of the potato has been produced to the disadvantage, at the expense of, or at least in greater proportion than the others, and that this, no matter in what way, has been the cause of a weakened organism, and consequently of the disease. Others again explain the action of the atmosphere as merely serving as a vehicle to (what they imagine to exist in it every where) myriads of minute seeds of fungi, which, when the air is in a comparative rest, should be enabled to enter into the minute pores or stomata, which exist chiefly on the surface of the leaves. This is one modification of the fungal theory, of which another is, that the seeds or sprouts of the fungus are inherent to the potato, growing up along with it, and only developing themselves in case external circumstances occur that are favourable to their growth, and which, it is understood, ought at the same time to be unfavourable to the growth of the potato. In this modified theory, therefore, the atmosphere does not act merely as a vehicle. If we consider in what manner the defenders of this fungal theory—who ascribe the cause of the disease to the action and the very existence of a fungus or parasite—explain the particulars, we will again find a discrepancy; for some, confining themselves to mechanical action chiefly, think that the fungus, whilst developing itself from the interior or cellular tissue, extends its ramifications through the pores or stomates in such a manner that these are entirely closed up, and thus the plant is made to die from want of perspiration and absorption, or, more generally, from the action of the stomates being thus essentially interfered with. Analogy has here been drawn from the phenomena of the animal kingdom, although, as is frequently the case, the grounds for this analogy have never been positively and clearly stated and proved. Another way of viewing the matter is, that the developing fungus robs the mother plant of its nourishing sap, and makes it die from exhaustion; while others still less positive in their reasoning do not hesitate to state, that the fungus poisons the parent plant, without thinking it even necessary to explain the nature of the fungus, the kind of the poison, and to prove that such a vegetable poison, if existing, would be able to kill the plant.

One of the grounds produced by those that adhere to the fungal theory, and seemingly considered as impregnable, is, that the species of fungus that are related to the fungus of the potato

do not live upon putrescent matter. But even granting that the observation of the habits of such minute beings could be executed with sufficient certainty, and that it was literally true that the botrytis of the potato cannot live upon putrescent matter, the existence of these fungi in ordinary putrescent substances does not necessarily prove that they are the causes of the putrefaction. The term "putrefaction" is still so vague and indefinite, and is frequently applied to so many similar and yet different phenomena, that it is quite possible that at a certain state of fermentation, which is not a real putrefaction, moulds or fungi may be produced, which speedily disappear again, because another state of fermentation has commenced, characterised by the production of new fungi, and at the same time attended with circumstances unfavourable to the existence of the former. In every different state of fermentation new combinations are formed and others destroyed, new forms are produced; and all this, aided by variations of temperature in the fermenting substance, may very well give rise to various and constantly altered forms of these microscopic cryptogams.

According to our before-mentioned intention, we shall not enter at present upon any discussion as to the probable cause; for no other reason than that our ideas have not yet been sufficiently matured, and require further proofs and further chemical investigations. Hence it cannot enter into our mind positively to propose any cure as yet, although the cutting of the shaws, even if the tuber might not be quite ripe, which was perhaps a matter of doubt at the period in which the disease commenced this year, will be effectual, provided the tuber itself had not yet been affected.

Whatever others may say or think, it is doubtless that, until the cause of this disease is known, no efficacious remedy can reasonably be expected to be found. It is the department of science to proceed from *fixed* points, from causes into effects, and every other way is hardly deserving of any other name than that of empiricism.

We would go further still, and say, that even although the cause were duly known, however indispensable this may be, we could not, however, from the defective state of our knowledge of the physiology and pathology of plants, undertake the cure with the same confidence of success with which the physician places himself before his patient, to attack and overcome an illness.

But still, without being acquainted with the cause of the disease, a variety of remedies will be tried in vain, and, what is worse, remedies which may easily injure a plant which has frequently been unnaturally cultivated. The steeping in dilute sulphuric acid, dusting with lime and gypsum, the application of sulphate of copper, arsenic, &c., may prove beneficial for the moment, but

how all this will affect and alter the nature of the potato, it is only for future experience to make out. Such kinds of treatment will be resorted to, if we proceed upon the belief that a fungus acts as the cause of the disease. The purpose is to kill the enemy; but does one always sufficiently consider that the injury intended for it may not also affect its victim? We might, perhaps, ask the propounders of this fungal theory, whether the growth of this parasite is promoted by atmospheric influences alone, or if the weakness of the parent plant be a condition also? whether one of the two—and if so, which—be the chief condition for the growth of the parasite, or whether these two causes depend upon each other? With regard to this, it can scarcely be assumed, that the weakening of the parent plant should so soon be caused by the state of the atmosphere, which is seldom or never the same in two successive years. As long as this point is undecided, it is uncertain whether the plant should be cured directly, or indirectly by destroying its enemy, and, in fact, the few satisfactory results, hitherto obtained by one of the abovementioned remedies, show that the general effect has been far from encouraging.

But if we adhere to the opinion, that the unfaveurable state of the weather has been the direct cause of the disease, by, no matter in what way, altering the functions of the plant, then there is certainly something true in Professor Morren's remark, that this theory, in point of curing the disease, is dangerous in its effects upon the mass of farmers, who, being powerless against such an enemy, may easily fall into that state of indifference, which is not unfrequently considered as characteristic of their class. Another fear existing last year, that they might think the recurrence of precisely the same state of the atmosphere so unlikely, that they would entrust their tubers to the soil without any precautions being taken, has now made room for another, that they will perhaps no longer entrust the seed to the earth, but allow the useful potato to go altogether out of cultivation. Such effects could scarcely be prevented from mastering a class of men who are generally so beset with prejudices, and it becomes so much the more the duty of the enlightened to enlighten them, and not to rest until their aim is obtained, and better modes of culture, founded upon physiological principles, are introduced.

The remedy, which results from the application of the epidemic theory, seems certainly to be entirely in the power of the farmer, without being attended with the injurious effects that may follow from the attempt of destroying the parasite directly: we mean the enclosure of the potato fields, to prevent the supposed introduction of the imagined seeds of the parasite by currents of air. Yet if this remedy, as is likely, might prove

ineffectual, the opportunity of preserving the crop is gone, and the evil will rage on undisturbed.

But there is something more reasonable in the idea, to turn the whole attention to the diseased plant itself; to allow those to be lost that are hopelessly attacked, to be cautious in attempting to employ the less diseased for seed, and to be satisfied with employing what has hitherto escaped, either of fine or of coarse varieties. If this be accompanied with judicious cultivation; if sound seed, chiefly from varieties that have suffered least, be planted in soils similar to those where the disease has least prevailed, and if the methods be imitated of those who have had small or moderate, but comparatively sound, crops—as well in regard to treatment, kind and quantity of manure, and period of application, as to depth of planting, distance between the plants, and time and mode of cutting, then something is put into the power of the farmer, which being faithfully copied from the prescriptions of nature, may justify the persevering man in expecting a slow, but gradual and continual remedy, and recovery of what has been lost. We look upon a sudden and entire cure almost as an impossibility.

Among the many conceptions that have been formed with regard to this case, one general deduction seems to be natural, viz.—that a disease, so general and occurring under so manifold circumstances, and yet presenting so much similarity in its appearance, must have had one general cause, which existed every where, and was only modified by, but remained further unchanged under all accessory influences. The mysterious nature of this cause, and the obstinacy of its effect, ought to stimulate us to increase our efforts, to enter into the most minute details, to consider the most minute particulars that may bear upon the knowledge of the physiology of the plant; for, as we stated above, no certainty can arise from proceeding upon uncertain principles.

In conclusion, we would offer the following brief statements, which, if fully borne out by more extensive investigations, might not be unproductive of beneficial results.

Every species of plant appears to require a certain definite proportion of substances in its organism, to make it operate regularly for its healthy growth. Too great a deviation, exceeding a certain maximum or minimum, will have an injurious influence upon the growth, by either accelerating or retarding it in too great a degree.

As soon as a plant, both the parts that live in the air and those placed in the soil, have obtained their proper quantity of constituents, the growth is completed. After that, it will take up nothing or little more, and being continually placed in the midst of substances that are always in a state of decomposition—

which was before a requisition for the growth of the plant,—this state will, after the growth is completed, communicate itself to the plant and its constituents. This will be the case even although the plant be perfectly sound, (and we do well, therefore, to remove a product from the plant when ripe and fully grown;) but much more rapidly when it is in a state of ill health. Both the want of activity of the cells and their contents, when the growth is too languid, and their too great activity when the growth is too quick and strong, will predispose the plant to this chemical change. The altered energy of the action of the matter, of which it is composed, will continue after the growth has ceased, but now it will proceed in another direction; all the peculiar properties and combinations of matter, which present themselves during lifetime, and on whose existence the vital actions depend, being now obtained and produced, another series of properties exhibit themselves, and a number of other combinations is formed. If the growth has been too languid, those combinations, necessary for the performance of the vital functions, will not be produced in sufficient quantity, and the altered activity of matter will commence before the growth is completed. In case the growth were too rapid and strong, the same increased activity of matter will continue after the plant has reached its maximum of growth, but will now, of necessity, take another course; the plant absorbing nothing more, and, consequently, vital action resting, decomposition sets in, and the degree of its action is entirely dependent upon the activity of matter, which again is determined by the quantity of substances fit for undergoing decomposition, in a certain space, and upon the co-operation of temperature, air, and humidity. It might be of some importance, to view in connection with this, the early appearance of the disease this year, although it seems uncertain whether the time of ripening or full growth had also arrived sooner.

It is a fact, that diseased potatoes sprout with remarkable rapidity; whilst the experiments of Professor Vrolik, above mentioned, show that perfectly sound potatoes remain in the soil for four months without any signs of sprouting being perceptible. This fact does not contradict the above-mentioned idea, and will actually tend to corroborate it, if it may be proved by experience that diseased tubers, although producing plants that remain healthy for a time, will, however, make them *inherit*, as it were, their own unnatural rapidity and luxuriance of growth, and the consequences attending these.

What has been here said, we repeat, are merely *ideas* to which we are far from attributing any practical value. Time will show, and further investigations, entered into with perseverance, will prove how far these ideas deviate from reality and truth.

Electro-Culture. By Mr George W. Hay, Whiterigg, Roxburghshire.—A year or two ago the agricultural world was somewhat agitated by statements emanating from Dr Forster of Findrassie, of so novel a description, that many were induced to follow the plan adopted by him for obtaining from the ground a much larger produce than it was possible to do by any other means. Whether others were as fortunate as himself in electro-culture, I am not aware, but I am sure in my own case that I have derived no benefit from following his instructions. At the same time, I have had much gratification in pursuing the course pointed out by him, as well as in adopting the ideas of Dr Fyfe and Mr Sturgeon, who have tried various experiments on the subject.

I am much disappointed that no practical farmer has written on electro-culture, as the ultimate benefit, if any, to be derived from it, must accrue to him, and not to the man of science; and it is solely to supply such a desideratum that I have been induced to give some results, which, I regret to say, are not in favour of that "new agent," which a sanguine writer in the "Economist" some time ago said "as one likely before long to produce as great a revolution in agriculture as the inventions of the steam-engine, or the spinning-jenny have done in manufactures," "and as likely to present a very full compensation for the exhaustion of Ichaboe."

Last year we had a large pamphlet, containing a collection of agricultural matter, chiefly relating to recent improvements and experiments, interspersed with scientific observations from Mr Mechi, who is an improver and experimenter to some extent, and who told us "that he was to electrify some fifty acres or more," and for the results of which I have been anxiously looking.

In the March number of this Journal, we have a long and elaborate essay by Mr Sturgeon, who supports the views of Dr Forster, and details a number of experiments conducted by himself; but, unfortunately, their results are not tested by weighing; although we have his testimony, along with that of the reapers and others, that the several plots of ground electrified were superior to other portions of the fields.

On the other hand, we have the several experiments conducted by Dr Fyfe, given in a paper read before the Society of Arts, Edinburgh, and all of which were unsuccessful. The observations which I have made entirely coincide with his as regards the wires' action on the magnetic needle, and I would consider Dr Fyfe's evidence conclusive on this point, as he used copper wires in his experiments, while Dr Forster used iron;—my own trials were with iron wire, and I found the deflections varied according to the position of the needle.

In the postscript to Mr Sturgeon's essay, which is evidently penned with a view to counteract the effects which Dr Fyfe's

paper might be considered to have upon his own, it is said, "Now, as it is possible that the magnetic action in question was due to the *iron wire* employed at Findrassie, Dr Fyfe's *copper wire* would not produce a similar result," which I take as a tacit acknowledgment that such was the case; and, with regard to the remarks on the galvanic experiments, I can only say, that in three trials conducted by myself, and having no connexion whatever with the ground, I failed to produce the expected results.

Again, we have successful experiments on turnips, &c., by Mr Sheppard; but who, while he tells us that "the largest turnip was found to measure 40¼ inches in circumference, and to weigh 16½ lbs," also says, that "the aggregate weight of the turnips, on the galvanised plot, was 27½ lbs.;" so that the other turnips, on the same plot, must have been very small, only 11 lbs. being allowed to them; but still this is exactly double the aggregate weight of the whole turnips growing in the natural manner, which is a great result; but while he mentions the great difference between the two products, he candidly adds, "but how far the above increase, on the galvanised side, was really due to this cause, or to any unknown accidental circumstance of seed or soil, it would have seemed premature to decide from the result of a single trial."

With this remark I entirely concur; for in selecting a plot of ground in a garden, as has been done in almost every case, we cannot tell in what state the ground is at the time—how it has been cropped—how it may have been manured; and in the few seeds, or few plants, experimented on, such diversity exists, that we often make false conclusions, and so give to the agent we have made use of, a merit to which it has no claim.

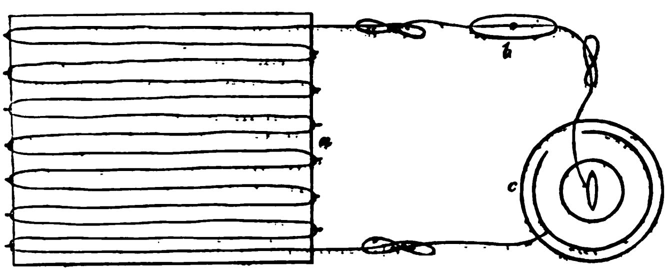
My regret is, that all the experiments made known to the public, as far as I can ascertain, are on a small scale, with the exception of Dr Forster's, and have either been conducted by means of a galvanic apparatus, or on the Findrassie principle; but to so minute an extent, as to leave doubts in the mind of the agriculturist whether or not he should incur the estimated expense of L.1 per acre over and above his other heavy outlays; and while there is such a contrariety of opinion among scientific men, whether electricity forwards or retards vegetation—it is not for the farmer to undertake rashly both trouble and expense without having something like a certainty of being recompensed.

It is singular that so little has been seen from the pen of the originator; and it is now two seasons since his paper appeared, which related the enormous produce of barley derived from the experiment. This silence would seem to indicate that his subsequent experiments, if any were made, had not produced the same beneficial results; but we can scarcely suppose that one trial would have satisfied so expert an experimenter as Dr Forster.

Having tried three different plots of ground in the same field and on the same ridges, but with forty yards intervening, on three different principles, and having had corresponding plots non-electrified, I purpose to give the results of these; but before doing so, I may be allowed to give the results of three galvanic experiments which I made.

First Experiment, with Cress Seed, on the 20th June 1846, at 6 o'clock, P.M.—Took two pieces of board of the same size, each eighteen inches long by fourteen inches broad, one of which had pins fixed at each end, about two inches apart, and copper wire wound round these, crossing from end to end over the whole upper surface, the two ends of the wire being attached to the wires of a small jar galvanic battery,—a galvanometer being introduced on one side,—and upon the surface of the wires was placed a piece of flannel well soaked with water, upon which was thickly sown the cress seed. This board was set upon glass jars, so as to insulate it, and the terminations of the wires were then connected with the battery, which was supplied with nitric acid diluted thirty times.

This figure represents the board, battery, and galvanometer in their relative positions, where *a* is the board with the wire twisted upon it, *b* the galvanometer, and *c* the galvanic battery.



The non-galvanised board had the flannel laid over it, and the seed sown, the two boards being treated in every way the same, except that this board was not insulated at first.

21*st June.*—The whole was well watered, and the continued action of the battery was shown, from the galvanometer having been left from the first attached to the apparatus.

22*d June.*—Examined both boards about ten o'clock forenoon, and found that a few of the seeds on the non-galvanised board were sprung, none being sprung on that of the galvanised; insulated the non-galvanised board, and placed the ends of flannel of both boards into jars of lukewarm water, having previously watered them with the same water in order to keep the seeds in moisture.

4 P.M.—Very many of the non-galvanised seeds have shoots on them as long as a quarter of an inch, a few only of those galvanised beginning to burst, and none sprung.

23d June, 10 A.M.—Both looking well. The galvanised one, however, decidedly inferior to the other, both in the number of seeds shot, and in the stage of advancement. Gave both an equal quantity of lukewarm water; a distinct current indicated by the galvanometer.

2 P.M.—In both cases considerable advancement, but the galvanised one even further behind the other than at the last inspection.

4 P.M.—Chanced to see the gardener passing; so called him in, and, without affording any information, asked his opinion. "I'll gie ye that," said Sandy, "an' nae muckle difficulty; this ane's the best, as ye maun see is quite discarnable; there's hantle mair growths here, an' they're hantle langer tu." Sandy here pointed to the non-galvanised seeds, and seemed quite clear on the point of their superiority. This opinion was confirmed by several other persons during the day. Gave both an equal quantity of water; the galvanic current distinct; there was no sun during the day; the thermometer varying from 68° to 70° in the house.

8 P.M.—Again supplied an equal quantity of warm water.

24th June, 7 A.M.—Gave a supply of water to each.

Mid-day.—Both considerably advanced since yesterday, but galvanised still much inferior; no action on the galvanometer; new zinc attached, and distinct action indicated.

6 P.M.—The non-galvanised still far a-head, being more advanced in length, and over all the board equally so. The half of the galvanised board next to the battery far inferior to the other half, being as yet scarcely sprung.

25th June, 10 A.M.—Both improving, but the non-galvanised still superior. Gave to both an equal quantity of lukewarm water.

26th June.—Non-galvanised as yesterday in advance of the other. Galvanic action indicated, warm water supplied at 6 A.M. and 4 P.M.

29th June.—The superiority of the non-galvanised over the galvanised somewhat diminished since last inspection, but still quite evident. Galvanic action indicated by galvanometer; equal quantities of water given to both.

30th June.—The end of the non-galvanised board, where the flannel dips into the water, and which is somewhat shaded by a pillar of the window, is very much in advance of the other end. The best part of the galvanised board is furthest from the light, next to the battery, but not on the side the flannel dips into

the water. Fresh water given to both; galvanometer indicates a distinct current.

2d July.—From this date the water is to be of the natural temperature. The superiority of the non-galvanised over the galvanised still becoming less evident; the galvanised is more uniform, but still the whole weight of the produce of the non-galvanised would far exceed that of the galvanised. Some of the shoots of the non-galvanised measure, without roots, 2½ inches, while the longest of the galvanised do not measure 1½ inches.

3d July.—Galvanic action indicated, fresh water supplied, no change worthy of notice since last inspection.

6th July.—Both crops beginning to wither; a regular supply of fresh water twice a-day since the 3d; no galvanic action. The withering uniform over the whole board in both cases.

7th July.—No galvanic action, withering fast.

9th July.—On raising the flannels from the boards, it was discovered in the case of the non-galvanised, that the roots had pierced the cloth to such an extent as to form a perfect matting; while in the case of the galvanised, scarce a single root had passed through the flannel. Those that *did* pierce the flannel could hardly be said to have followed any order, but were scattered here and there over the whole surface; if any thing, however, they were more abundant where the flannel touched the very edges of the board.

Second Experiment, with Turnip Seed, 29th June 1846, 9 P.M. —Took two boards of about the same size as those in the first experiment, one of which had wires crossing over it, and attached to a small jar battery, a galvanometer being placed as before. The flannel in this case being much coarser, thicker, and opener in the texture than in the last experiment. Insulated both boards, and thickly strewed over them white globe turnip seed, watering them with lukewarm water, adding diluted nitric acid to the battery, and the galvanometer denoting action, were thus left for the night.

30th June, 8 A.M.—Galvanometer denoting action, a few of the seeds on both boards chipped, equal quantities of water supplied to both.

½ past 2 P.M.—Water supplied, found little difference on the seeds.

½ past 9 P.M.—Little difference observable on the seeds from the morning. Supplied water to both; find that the galvanised piece of flannel dries faster than the non-galvanised; distinct current indicated.

1st July, ½ past 8 A.M.—More of the seeds burst on the gal-

vanised than on the non-galvanised, watered both with an equal quantity of water, galvanometer denoting action.

½ past 3 P.M., ½ past 6 P.M., and ½ past 9 P.M.—At each of these times find that the galvanised is still a-head, galvanometer indicating a current, watering as before at each time.

2d July, 10 A.M.—Scarcely know any difference now between the seeds, the galvanised rather the preferable.

½ past 2 P.M.—Same as before in every thing.

10 P.M.—Can tell no difference, both seem to be equally sprung, battery in action; added a very small quantity of diluted acid, and watered as before.

3d July, 10 A.M.—Watered as usual, find that the non-galvanised is as far advanced as the other.

2 P.M.—The non-galvanised rather in advance of the other.

½ past 9 P.M.—Same as last, the non-galvanised having rather more green leaves than the other.

4th July, ½ past 7 A.M.—Battery in full action, the non-galvanised still furthest in advance.

2 P.M.—Same as last, leaves formed on the non-galvanised.

½ past 9 P.M.—The galvanised still behind, but absorbing more water than the other.

5th July, 9 A.M.—Watered as usual. Battery in full action, both progressing much the same as last night.

6th July, 9 A.M.—Find the non-galvanised still a-head of the other, watered both, and still find that the galvanised absorbs most water.

½ past 2 P.M.—Supplied fresh water, non-galvanised still a-head.

10 P.M.—Same as before in every particular.

7th July, 9 A.M.—Battery weak, but acting; watered as usual, and can see no difference from former observation.

2 P.M.—The non-galvanised decidedly longest in the stem, and more equal, the galvanised higher in the middle than at the sides.

9 P.M.—Gave an equal supply of water to both, the battery in action, but weak, otherwise the same as before.

8th July.—Find the battery weaker, but in action; added a little more of the acid, which increased the action; the non-galvanised far a-head, both longer in the stem and the leaves much more expanded than in those of the galvanised.

9th July, 10 A.M.—Watered as usual, still the non-galvanised in advance.

9 P.M.—Same as before, and see no use in proceeding further with the experiment.

Third Experiment, with Turnip Seed, 13*th July*, 9 A.M.—Re-

newed the battery, and began this experiment upon the same boards, with the same materials as in the former case, the only difference being, that the flannel was watered only once a-day, instead of three times. Again used white globe turnip seed, which was thickly strewed over both pieces of flannel, and soaked with tepid water.

21st July, 1 P.M.—Without giving the details, I only state that the seeds have not been watered since the 18th. On examination this day, find that the battery is in action; that the non-galvanised plants are more advanced, and more equally sprung over all the board than the galvanised; and on taking off the flannel from the boards, find that the non-galvanised have the roots quite through, and thickly matted together over all the under surface—that the galvanised have the roots also quite through, and matted together in stripes between the wires, a space being left for every one, so that no roots were in contact with them, shewing the disinclination on the part of the roots for galvanism.

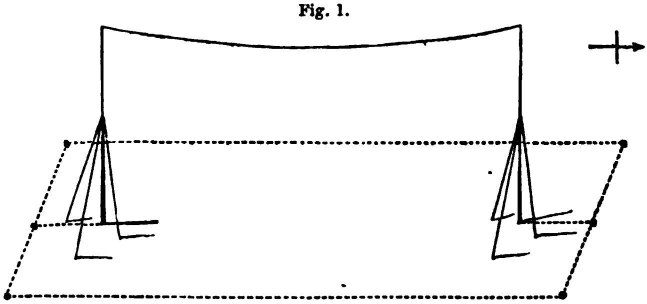
I make no remarks on these experiments, but leave them to the reader to judge for himself.

The following experiments are those on electro-culture, and without further preface I shall enter upon the particulars. My experiments on electro-culture were conducted upon a field, the soil of which is cold thin clay upon an impervious subsoil—which had lain in grass for about 12 years. In the winter of 1844-5 it was drained with stones every 24 feet, and top-dressed with earth and lime to the extent of 84 carts-load per acre, and allowed to lie in gear during the summer of 1845, ploughed up into double ridges early in the winter of that year, and sown with Sandy oats the first week of April. Five of the double ridges were sown on one day, in two of which wires, as afterwards described, were placed. Portions of ground corresponding with those within the wires were marked off on two double ridges to the east and to the west. The reason for keeping the double ridge on the west, as well as on the east side, was, that the land gradually grows better to the westward, and in fairness it was thought advisable to keep a portion on each side of the wires.

First Experiment—The wires were laid down on Dr Forster's plan, enclosing an area of 16 yards by 55 yards, equal to 29 poles 2 yards. Poles were placed nearly in the centre of the ground, 5 yards from each end, one of them being 15 feet, the other 14 feet. The enclosing wires were sunk to the depth of 3 inches, and held in their places at the corners by means of staples. At the centre of the end wires another wire was attached and carried underground to the foot of the poles, upwards over their tops, and left suspended between the two poles, exactly as recommended by

Dr Forster in every particular, the wires being laid by compass. Fig. 1, represents this method of arranging the wires.

Fig. 1.



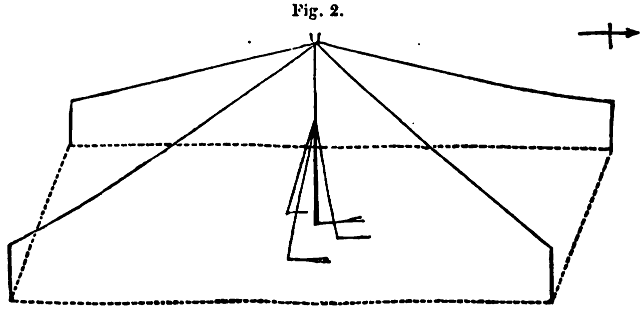
On the same day tried the effect produced on the magnetic needle, at different points, the wires being laid bare for that purpose. At the north-west corner—found the needle, when placed outside of the wire, repelled about 14°; when inside, merely a deviation of attraction. South-west corner—exactly the same results, as well as at the south-east. At the point where the suspended wire from the poles unites with the underground wires at the end, when the needle was placed inside of the corners, the repulsion or attraction was greater according as it was held to or from the iron staple which kept the wire in its place—evidently shewing that the iron, and not any flow of electricity through the wires, caused the variation. When the needle was held over the wire, or placed immediately beneath it, there was no deviation whatever.

1st May.—Examined the plot narrowly, and could see no difference on the braird within the wires from that without.

8th May.—Examined the plot carefully in comparison with the surrounding ground, and could observe no difference whatever.

30th May.—Laid down wires enclosing the same number of yards of ground as before, on the same number of ridges, but at the lower end of the field, the principle being that recommended by Mr Sturgeon, as in fig. 2, having a pole in the centre of the plot, about

Fig. 2.

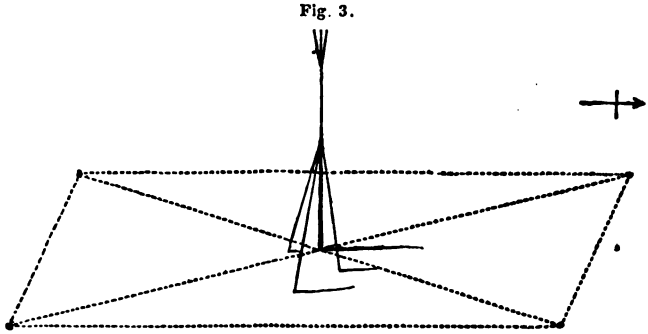


18 feet in height, and wires crossing the top of it from the

south-east corner of the plot to the north-west, and from the south-west to the north-east. These wires were raised at the four corners by poles of about 3 feet high from the ground, and the suspended wires were connected with those underground enclosing the plot.

2d June.—Laid down another set of wires around a plot of ground of the same size, and on the same number of ridges, and placed exactly between the two former plots, having more than 40 yards from them, to prevent communication. This was upon the plan suggested by Dr Fyfe, as in fig. 3, having a

Fig. 3.



pole of about 20 feet high in the centre, with a wire running along it, branching out at the top into three prongs, each 18 inches above the pole, and at the bottom connected with diagonal wires running underground towards the four corners, at which points they were joined to the wires enclosing the plot.*

5th June.—Examined all the plots with two friends, and none of us could see the slightest difference on any of them, not even on the one first laid down. A great deal of electricity in the air this week, and thunder heard for three successive days.

10th June.—Met a gentlemen to-day who told me that he had looked with a friend at the portions of electro-cultured ground in my field, and both were of opinion that the enclosed plots were more yellow and thinner on the ground than the other portions of the field.

11th June.—Examined carefully by a friend, who gives his opinion, that the oats within the wires on all the three portions do not look so well as those beyond them, and those on the western side are worse than on the eastern.

There was a very severe thunder-storm on the 18th, and I understand there has been less or more thunder every day since.

27th June.—I cannot say that I see the smallest difference in any of the plots from the ground surrounding. There is a degree of yellowness on the ridges upon which the experi-

ments are going on, as well as those near them, but whether caused by the wires, I am not prepared to say.

9th July.—Examined the different plots to-day, and am of opinion, that the crop on the surrounding ground is more vigorous than within the wires. Since the last date, another very severe thunder-storm, and much wet weather.

28th and 29th August.—No examination of the crop within or without the wires was made from the 9th July, as injury would have been done by walking amongst it. At these dates the crop was cut, the portions enclosed, as well as those on either side, being all ripe.

9th and 14th September.—The corn in the straw was led off the field and weighed, after which it was put up in small stacks, each kept separately. It will be seen by the annexed table, that in each case the *west* side is heavier than the electrified, and, with with the exception of that marked "Sturgeon, electrified," the east side is also heavier, there being only a deficiency of 7 lbs. on the east side, whereas there is an increase of 3 qrs. 23 lbs. on the west side over the electrified. But, upon the whole, it will be seen that the total on the east side is 3 qrs. 22 lbs., while that on the west side is 4 cwts. 2 qrs. 12 lbs. over the electrified.

	West Side. Not Electrified.	Electrified.	East Side. Not Electrified.
	Straw and Corn.	Straw and Corn.	Straw and Corn.
Forster.	cwt. qr. lbs. 4 1 21 which, being doubled, to make the ridges all equal, gives 8 3 14	cwt. qr. lbs. 7 1 16	cwt. qr. lbs. 8 0 0
	Straw and Corn.	Straw and Corn.	Straw and Corn.
Fyfe.	cwt. qr. lbs. 4 1 14 being doubled gives 8 3 0	cwt. qr. lbs. 6 2 9	cwt. qr. lbs. 7 0 0
	Straw and Corn.	Straw and Corn.	Straw and Corn.
Sturgeon.	cwt. qr. lbs. 4 0 9 being doubled gives 8 0 18	cwt. qr. lbs. 7 0 23	cwt. qr. lbs. 7 0 14

16th September.—Thrashed all the different lots, bagging up the corn separately as it came from the mill, to be afterwards dressed.

17th September.—The different parcels of corn were dressed, and the annexed table gives the results, the boll containing 6 bushels.

	West Side. Not Electrified.	Electrified.	East Side. Not Electrified.
Forster.	bolls. bush. Heavy corn, 0 $5\frac{7}{10}$ Light do. 0 $0\frac{4}{10}$ Being doubled, 1 $0\frac{2}{10}$ gives total of 2 $0\frac{4}{10}$ Weight of heavy corn, $37\frac{1}{6}$ lbs. per bush.	bolls. bush. Heavy corn, 1 $3\frac{7}{10}$ Light do. 0 $0\frac{7}{10}$ Total, 1 $4\frac{4}{10}$ Weight of heavy corn, $37\frac{1}{6}$ lbs per bush.	bolls. bush. Heavy corn, 1 $3\frac{8}{10}$ Light do. 0 $0\frac{8}{10}$ Total, 1 $4\frac{6}{10}$ Weight of heavy corn, $37\frac{1}{3}$ lbs. per bush.
Fyfe.	bolls. bush. Heavy corn, 0 $5\frac{4}{10}$ Light do. 0 $0\frac{6}{10}$ Being doubled, 1 0 gives total of 2 0 Weight of heavy corn, $37\frac{1}{6}$ lbs. per bush.	bolls. bush. Heavy corn 1 $2\frac{2}{10}$ Light do. 0 $0\frac{8}{10}$ Total, 1 3 Weight of heavy corn, $37\frac{1}{6}$ lbs. per bush.	bolls. bush. Heavy corn, 1 $2\frac{5}{10}$ Light do. 0 $0\frac{7}{10}$ Total, 1 $3\frac{2}{10}$ Weight of heavy corn, $37\frac{1}{3}$ lbs. per bush.
Sturgeon.	bolls. bush. Heavy corn, 0 $4\frac{8}{10}$ Light do. 0 $0\frac{7}{10}$ Being doubled, 0 $5\frac{5}{10}$ gives total of 1 5 Weight of heavy corn, $37\frac{1}{3}$ lbs. per bush.	bolls. bush. Heavy corn, 1 2 Light do. 0 $1\frac{6}{10}$ Total, 1 $3\frac{6}{10}$ Weight of heavy corn, $37\frac{1}{3}$ lbs. per bush.	bolls. bush. Heavy corn, 1 $2\frac{8}{10}$ Light do. 0 $0\frac{8}{10}$ Total, 1 $3\frac{6}{10}$ Weight of heavy corn, $37\frac{1}{3}$ lbs. per bush.

I have thus recorded the results of the different experiments on electro-culture, from which it will be seen that, in these trials, there is little or no difference between the produce of the electrified and non-electrified portions of ground,—none at least in favour of the former.

I shall refrain offering any remarks upon these results, and so shall leave them for the consideration of my brother agriculturists; and it is for them to determine whether the expense incurred in laying down the apparatus will be at all compensated by the product obtained. The extraordinary result of the experiment of Dr Forster is thus more and more a mystery to me, but I hope that it will this year be either corroborated or confuted by similarly repeated experiments.

I am quite open to conviction, and shall rejoice to find that others have derived benefit from their experiments; and, should that be the case, I may be induced to give the matter another trial—though, under present circumstances, I have no intention of doing so.

Electro-Culture—Trees—Hedges. By Henry Chaytor, Esq., Clerveaux Castle, Doncaster.—In the investigation of philosophical facts connected with agriculture, it seems pretty certain that individual observers have not *in general* sufficiently extensive opportunities to enable them to draw safe and correct conclusions. A very great tendency exists, upon insufficient examination, to make important deductions, and lay them before the world with a confidence calculated to mislead the comparatively ignorant, amongst which class by far the greatest portion of agriculturists must be comprehended. I do not mean that this fault is to be ascribed solely to those whose opportunity for observation is almost confined to their own boundary-fence, and whose opinions are often held with a tenacity, in converse proportion to their own limited sphere—but frequently to those whose inclination or occupations mark them as leaders in agricultural science. It is impossible to calculate the mischief that may be done to the cause by such want of caution—notwithstanding the vitality of its progress appears at present too great to be easily destroyed. The recent discussions on the potato disease display many notable examples, and I should certainly have been put to some useless expense on that crop, if my "hands" had not been so fully occupied. As it was, I only gave them a top-dressing of guano, in hopes to force them forward before the tops should be blighted, after which the tubers could not be expected to increase much, if any thing, in size. I also cut off some of the tops, which did not seem to make the least difference. But I must now offer the few remarks I have to make on electro-culture, and the influence of trees and hedges, which seem inseparable from the subject.

I am not going to deny its effect on vegetation. The evidence on this head seems sufficient, and has repeatedly led to the conclusion, that electricity is vitality to plants. There appear strong reasons to think that it is the source of animal life also, and many medical men entertain this opinion. But it is questionable if it is advisable to cover the land with posts and wires to increase the natural supply. We are told by Liebig, that in Germany, when a field is marled, the occupier of the adjoining field is compelled, in self-defence, to marl his also. I presume the reason to be, that his neighbour would get nearly all the gases from the air and leave him a short supply. Would

not a similar result be produced in electricity by the use of wires? If I saw my neighbour erecting the apparatus, I should feel that self-defence required me to do the same. I should feel that the current of air that visited my field, after leaving his, was less pregnant with the subtle fluid; and if this idea is correct, and was carried out, the whole land would become covered with the unsightly erections, and perhaps no one would then be benefited. How far this would be the result, or whether the fluid would be immediately replaced from above, will require investigation.

At present trees—those much dreaded monsters to most eager improvers—the poor trees, on which unlimited and unchecked abuse is daily heaped at almost every agricultural meeting, seem to perform the important, though silent duty, of discharging gently from the atmosphere the excess of electricity. They reach higher than the wires, and, presenting many points, seem well fitted to discharge the excess without entirely divesting the air of it. I have heard that a thunder-storm has been comparatively innocuous in its effects on crops in a well-wooded country, while the same storm has flattened them all where the trees were wanting. Have the electric waves nothing to do with laying the corn? The straw, from being a good conductor, in its green state, becomes a bad, if not entirely a non-conductor, when it turns colour and its juices cease to circulate. I leave this consideration to more refined electricians. But electro-culture has sometimes failed to produce any benefit. It is not, therefore, a universal specific; and as it does not bring with it the *elements* of plants, it is impossible it should be. The proper application of draining for wet land is the only remedy that has never been known to fail. Whilst on this subject, I beg to suggest to the occupiers of land adjoining an electric telegraph, who may wish to adopt the plan, that they should endeavour to *contract* for the use of the wires, which are generally well elevated and numerous, and I do not know that its efficiency, as a telegraph, would be impaired thereby.

In an excellent article, in No. 12 of this Journal, on "Electro-Culture," by Mr Sturgeon, the question is raised (p. 297) respecting the pernicious effects of the ash-tree on crops that come within its influence. For some time I entertained the opinion that its late vegetation, at the period when the cereals are beginning to push forth their shoots with vigour, was the chief cause. This seemed to be warranted by the ascertained fact, that the young buds require a large supply of alkalies for their development, and the perennial being the stronger, with its roots already pervading every part of the soil, obtained what it afforded in an available state. It is evident, however, that this cannot be the main cause, or it would apply to the elm, the

plane, and other early trees, as too short a period elapses between their shooting and that of wheat, to effect an adequate restoration in the soil. But, in truth, the result of my examination of the effects of trees on crops during the past summer, has induced the belief that the character of the ash has been somewhat vilified. I have seen turnips as much injured by the oak and by the elm, and wheat as completely damaged by the oak as ever I have seen it by the ash. I have seen cases where, in a deep and good soil, the ash produced no visibly bad effect. Nevertheless, I think it is *not* a difficult matter to account for the bad effects of trees. Would any farmer be surprised if, upon an average, or even any soil, he should fail—using no extraordinary means—to grow a good crop of wheat every year? Would he expect a much better result if he varied the wheat with oats and barley? Or, if he grew oats and barley mixed on a field in *good condition*, would he expect a full crop of each? He would not dream of it. Why, then, should he expect his soil to support a tree that had occupied it for many years, and another crop at the same time? The tree annually abstracts from the soil mineral substances for increase of wood and for leaves, of which, even the latter, though returned, are generally carried by the wind beyond the sphere of the roots, which is by such a process impoverished beyond the power of ordinary farm-management to restore. The worse the natural quality of the land, the more marked the effects. The thinner the soil, the nearer the roots are to the surface. Now, it is on these cold clays that the ash predominates, though it does not come to perfection. The oak, the elm, and the beech, are scarcely to be found there. The ash, every other year, generally bears a plentiful and exhausting crop of seeds. These being easily dispersed by the wind, accounts for its frequency. It remains to examine the roots. In the elm, they are long and radiating, with comparatively few radicles. In the ash, on the contrary, they are short—particularly on strong land—seldom reaching as far as the tree is high and covered profusely with rootlets, which pervade every part of the soil, and running close to the surface, are cut off by the plough, only to re-occupy it—hydra-headed—in greater force than before.

I think that we may safely come to the following conclusions:—That *wherever the roots of any tree occupy the surface soil, there the crops will be deficient.* That the roots of the ash in general run nearer to the surface than those of other trees; that they are more fibrous, and more completely occupy the soil, so far as they do extend; and, in addition, it bears great quantities of seeds. I have been told that occasionaly ash-roots have been seen above 100 yards from the tree, in the very middle of a field. In such a case, we may safely predict that the soil was both open and poor. I believe that ash leaves a greater per-centage of ashes when

burned than most other wood, and is one of the least durable; whilst oak, which is most so, contains the least mineral substance, only one-half per cent. Leaves, still more perishable, contain by several times more than the solid wood.

Mr Sturgeon, however, rides his hobby a little, when he refers to electricity as the cause of superior crops on head ridges. When this occurs, which is by no means universally, it may, with perhaps better probability, be referred to a combination of causes; and a chief one may be, that it is generally drier. Firstly, because there is usually a ditch on one side of the fence; and, next, because the thorn-roots, extending over it, assist in drying it very materially, by evaporating water through the leaves; and it is well known, that trees not too thickly planted, and also grain crops, have a most powerful effect in dispersing moisture. Again, when a field is in turnips, the mechanical state of the land is generally injured by its being worked so fine, (excepting gravelly soils,) that it becomes sad and retentive of moisture. The head ridge escapes this for the most part, and it gets an annual top-dressing of leaves, which, as the hedge is low, generally fall within its compass. The roots penetrating rather deeply, bring up and dispense by this means mineral wealth on the surface. If an old hedge on a poor soil be stubbed up, and its site ploughed over, the appearance of the crops will long vividly mark its former position; and the thorns being gone, it is in the same condition precisely as the surrounding land with regard to electric agency. If electricity were the cause, it would seem reasonable to conclude, that trees would have a more powerful effect than hedges, as, being higher, they will naturally collect more.

Admitting that trees do a partial damage, it would, notwithstanding, be unwise to cut them all down. In a letter in the "Gardener's Chronicle," about two years since, I remarked, "that hedges might be considered an artificial and convenient arrangement of the bushes which naturally occupy it in temperate climate before its cultivation. That large plantations could not, nor small ones as economically, be made a substitute for hedge-row trees, which, when in *moderate* quantity, amply repaid in many ways for any partial damage. That warmth was equivalent, to a certain extent, to food, whether to stock or plants. That a necessary shelter was afforded to birds, which were requisite to keep in check the insect tribes, which would otherwise become a serious plague."

The beauty of the tree-studded landscape is fortunately compatible with the strictest utility, and it behoves us to reflect most seriously before we interfere with a natural arrangement, which, framed by the hand of universal wisdom, infinitely surpasses all our invention; and that to man it is only given by the labour of

his hands and head to cultivate and carry out the scheme laid down before him. *We cannot have it all ways.* Let us, therefore, be content with that natural arrangement which, on due investigation, will be found, when followed in moderation, to present the greatest advantages—advantages that are doubly dear, as being coincident with a beauty that nothing else can equal.

A Means of Affording Employment to Poor Highlanders. By Mr HUGH WATSON, Keillor, Coupar-Angus.—Having lately had opportunity, by personal communication with some of the most influential and extensive West Highland proprietors of land, as also from written information and public newspaper report, of learning of the severity of the distress which the inhabitants of the Northern and Western Isles, as well as many of the inland Highland districts of Scotland, are inevitably doomed to suffer by the failure of their principal crop, unless relieved by an extraordinary interference of the government, or the sympathy and aid of their fellow-subjects, I have been compelled to turn my mind to this distressing subject, both from a sincere desire of using my best endeavours to aid in alleviating the misery of these poor sufferers, under the severe infliction with which it has pleased Providence to visit them, by the failure in their chief means of support, the *potatoes*, the almost total loss of which, for a season, *as food for man*, seems now to be ascertained beyond doubt, as well as to suggest the means of future independence for a portion of the many human beings so afflicted. The first step, of course, must be, to see that starvation is not the almost immediate consequence of the want of food, so far as charity can safely be applied to such a case; and I rejoice to observe, that much has been done, and will still be done, in this way. But I hold there is something radically wrong in the management of landed property, where such numbers of human beings are fostered upon it, as cannot be supported by some more proper means, than merely *keeping in their lives, by the smallest allowance of the poorest food*, and suffering them barely *to live and move*, without being able to turn their industry and exertions to any useful purpose, beyond the gratification the chief may feel, in lording it over so many submissive vassals, whom, in the day of need, he has not the means of even saving from starvation. Therefore, if starvation is likely to be the result, *for this season at least*, let their more fortunate fellow-creatures come forward with alacrity, according as God has blessed them with the means, and raise such a fund as will supply the material of subsistence, till other and more rational steps than have hitherto been resorted to shall be resolved upon by the Highland proprietors, or, if necessary, by the legislature, to prevent the recurrence of so great a national calamity.

The plan which suggests itself to me as likely to afford the most agreable *first step* to the Highlander, is to put into his power to *emigrate* into the more fertile districts of *his own country*, where his labour will be a source of profit to those who employ and pay him, and of infinite advantage to himself and family, (if he have one,) by at once raising him to independence, while his children will be reared under other notions than *merely to have existence.* For this purpose I would suggest, as *a partial relief*, that it be immediately ascertained, by the clergymen of every agricultural parish in Scotland and the north of England, to what extent labour is required, how many families the farmers of each parish could accommodate with houses and work on their farms, the males constantly for a year, the other branches of the family as the operations of the farm may require. Judging from the want of labourers at present felt in this district, I calculate, that each agricultural parish in Scotland would take a supply of not less than twenty families, and be glad to receive them, to fill up the want of labour, occasioned by a large portion of those formerly employed in agriculture now removed to the more profitable work on railways and in manufactories. It may be, that Highlanders may not be able to work *skilfully* at first in the various departments of farm-labour; but let them begin with their spades, or trenching and draining implements, and be paid in proportion to their dexterity, or by piece-work, and there can be no doubt the able-bodied, *if well fed*, will at last be capable of earning a decent livelihood; while the younger branches of the families, male and female, will be initiated into the best modes of working. Thus our Highlands and Islands will be, as must have been intended by the wise Disposer of all events, a source of national blessing and advantage, instead of a load upon the more cultivated districts, and in future years they would become a valuable nursery for supplying industrious labourers to our increasing manufactories, and improved system of farming the soil, which is annually becoming more dependent upon manual labour. In a short time, the first importation of labourers would be moved to better employment, such as they are suited for by their training education, and thus give room for another, and perhaps more extended, relief; and in, the end, their present apparent misery will have been only the first great step to their temporal, as well as improved spiritual happiness, by forcing upon them a change in every way for their benefit.

I am ready to accommodate from six to ten families on my own farms ; and if this forms any criterion, as I have no doubt it does, of the wants of others, occupying a proportionate extent of land, the relief to the over-populated districts of the Highlands would at once be very great, and almost sufficient for the present emer-

gency. At the same time, it must be expected that a like movement will be made *by manufacturers*, and other employers of labourers; or, if they urge that the Highlanders are not qualified to work in manufactories, let them come forward with present relief from their ample means, and look for their *ultimate return* to the supply of useful labour the agriculturists will thus have raised up for them, and this perhaps at no very distant period, should their present well-skilled artisans be induced to remove to other countries, as to a certain extent has already occurred.

It consists with my knowledge, that not less than two thousand men can immediately find employment, and good wages, on the line of railway forming from Stirling to Perth, and onwards to Forfar; and other lines are equally desirous of increasing their hands. So that whatever other calamities may exist in the Highlands, the want of employment for their inhabitants at present forms no part.

Mangel-Wurzel. By Mr PETER MACKENZIE, West Plean, Stirling.—The elongated ridges in many fields, instead of yielding the expected crop of wholesome tubers, have become the silent tombs to millions of potatoes; the weeds move over their rotten remains, and the charlock, thistle, and couch-grass, appear to thrive on their ruins. The losses that farmers and gardeners have met with in the cultivation of that precarious crop, will make them cautious for some time to come in planting it extensively; but it will not do to let the ground remain uncultivated; other plants must be sought for, and he who points out what may be useful, even though it should come from the antipodes, should be held in as much respect as the cultivator who has made two stalks to grow where only one grew before.

Some have already been brought into notice that are little known to the inhabitants of this country, others have been recommended which have been some time cultivated in various parts of the kingdom; and as it is not the first time that the mangel-wurzel, or root of scarcity, has been recommended when other things have failed, it may not be out of place, in present circumstances, to make known a few experiments we have made in the cultivation of this useful plant.

Various modes of cultivation have been adopted by different persons in this country, as well as on the Continent; for instance, a gentleman who resided some time in France, informed me, that he paid particular attention to the manner in which it was cultivated in that part of France, where he took up his abode for a time.

It appeared to be the custom there to have as much of the root above the ground as possible, and, instead of earthing it up,

it was the practice to take the earth away, so as just to allow as much to remain as would support the plants from falling over.

I have tried the growing of it in various ways, and have had opportunity of seeing it grown in the fields in England and Scotand; but the trials which I am going to give an account of were done in the garden in a variety of soils.

About the middle of April 1845, a quantity of seed was sown in drills, and also in a bed, intended for transplanting; the ground manured with well-made stable dung, and the quantity used was equal to that commonly allowed for potatoes grown in the fields in drills. The ground was well dug, was not put into raised drills as is commonly done, but kept flat; the rows were two feet apart; the seeds vegetated freely; and when the roots or fleshy parts of the plant were about four or five inches long, they were thinned, and the best of the plants saved for transplanting. We may state, that the soil in which the seed was thus sown was neither stiff nor light, but what is commonly called a good garden loam; a quantity of seed was also sown in a peaty soil.

It may be thought by some that the seed was sown too soon, when May is generally the month recommended for sowing it; but we should also bear in mind, that some allowance should be made for the climate of Scotland, and if the ground could be got ready in time, we would recommend sowing it earlier than in the south; the plants would have more time to grow, and very few of them would run to seed.

We will notice the soil in which the plants grew, and the different modes of treatment, in the following order:—1. Those sown in good garden soil, and allowed to remain until the end of October. 2. Those sown in peaty soil. 3. Those transplanted into light soil, and had part of the earth taken away from the roots. 4. Those transplanted into light soil, and the earth allowed to remain. 5. Those transplanted into stiff soil, and had part of the earth taken away from the roots. 6. Those transplanted into stiff soil, and the earth allowed to remain. 7. Those transplanted into peaty soil, after a crop of early potatoes. We may here state, that great care should be bestowed upon the transplanting, if success is expected to attend the operation. The plants should be thinned from the rows, or drawn from the seed-bed when the soil is moist; if dry and hard, the point of the root will break as well as many of the fibres; and when such is the case, they are of little value, for, though they will live after being planted, they will never arrive at great size. In order to attain as much of the root as possible, the ground should be well watered or moist until rain falls; the soil should also be in a proper state to receive the plants, being

well broken and stirred up; the dibble should be well put into the earth, fully as deep as the root will go. Let not the point of the root be curled or turned up in the hole, but let it be as straight as possible. It is not a bad plan, when planting in general is performed with the dibble, to make a hole at the side of the plant that is put in—for the purpose of holding a small quantity of water for the benefit of the plant; but in most cases, if the planting is well done, there will be few blanks, and the root will soon take with the ground. Hoeing and hand-weeding, as occasion requires, will be of great service; for, like most plants, they are all the better for having the earth stirred about them at times; but be cautious and not injure the roots while working among them with the hoe, for it is thought when the skin is broken they are apt to bleed to the injury of the root.

These hints may be thought too minute and trifling to be strictly attended to; but if it is required to make the most of the soil and dung, our time and labour, they are all necessary; and it is as easy to do what is right, when it is known, as to do wrong. The cultivator of plants, whether in the field or the garden, has many difficulties to surmount, and although he may meet with obstacles that may threaten to impede his progress, yet, by a little observation, avoid the danger, and with the poet say—

> "The hill of knowledge I essay'd to trace,
> That verdurous hill, with many a resting-place,
> And many a stream, where warbling waters flow,
> To glad and fertilise the plain below."

Where the soil is shallow or wet, it ought to be well ridged up and prepared, as for turnips; or, what is better, for all crops, such land should be well drained; and if the trench or subsoil-plough is put through it, something better may be looked for. According to the order formerly noticed, we will now give the result of each mode of culture.

1. Where the seed was sown in good garden soil, and the plant allowed to remain in the earth till the end of October, the crop gave of roots at the rate of 28 tons, and of leaves 5 tons per acre.

2. Where the seed was sown in peaty soil, and the plants allowed to remain in a growing state until the end of October, the crop was at the rate of 22 tons 4 cwt. per acre.

3. Those transplanted into light soil, and had part of the earth taken away from the roots, the earth not being removed until the plants were in a healthy growing state, nor removed all at once, gave at the rate of 13 tons per acre.

4. Those transplanted into light soil, and the earth allowed to remain, gave at the rate of 18 tons per acre.

5. Those transplanted into stiff soil, and had part of the earth taken away from the roots, gave at the rate of 11 tons 7 cwts. per acre.

6. Those transplanted into stiff soil, and the earth allowed to remain, gave at the rate of 11 tons, 2 cwt. per acre.

7. Those transplanted into peaty soil, after a crop of early potatoes, gave at the rate of 13 tons per acre.

Judging from the experiments now stated, and from observations in various parts of the country, a soil inclining to a sandy nature appears better adapted for the growth of mangel-wurzel than that which is more stiff and clayey; and although the plan of taking the earth away gives a little advantage in the stiff soil, yet the greater difference in favour of the earth remaining in the soil where the plants grow best, would be a sufficient reason for not adopting that system in general practice.

Although the transplanted crops are not equal in bulk to those sown, yet, in certain circumstances, it may be useful, where an early crop may be grown, such as early potatoes; which can be removed and the ground prepared for receiving the young plants of the mangel-wurzel, and they will come in very well where cows are kept, supplying them with a nutritious diet as long as it lasts.

The crops that were sown may not be so heavy as some we hear of, and better may be grown in a more genial climate; yet farmers allow that, when they obtain from 25 to 30 tons per acre in this country, it is worth the cultivating, and so far as nutritive qualities are concerned, it affords it largely, as both theory and practice agree. Thus 23½ tons per acre of mangel-wurzel yields as much nutritive matter as Swedish turnips of 33½ tons per acre.

The farmers of the present day know more about the feeding properties of the mangel-wurzel than when it was first introduced to Flanders. There is a story about it, which appeared in several periodicals some time ago.

When Napoleon was endeavouring to protect himself against the inconveniences felt from the impossibility of obtaining colonial produce, in consequence of the activity of the English cruisers, an order was given that measures should be taken to induce the Flemings to grow beet for sugar-making. The prefect of the department of Jemappes accordingly invited all the farmers of his district to set about the cultivation of the root, and distributed seed among them. The Flemish farmers hit upon its management immediately, and the first season gave them a large crop. But when the roots were ready, nobody

knew what to do with them, so the farmers resolved to cart them to the prefecture; and accordingly, one fine morning, the prefect was surprised by the arrival of heavy carts bringing him some hundred thousand kilogrammes of beet. Having no means of taking it in, for the buildings in which it was to be manufactured had not been thought of, he had no resource but to pay for the crop, and get the country people to cart it away again. This led them to consider whether cattle could not be fed upon it, and the result we all know.

It is not a good system, practised by many growers of this plant, to deprive the plants of many of their leaves before they have performed the office assigned them, for these are intended to convey nourishment to the roots, and they do so as long as they are in a healthy state; and those who have studied the various functions performed by the foliage, well know that such organs are both stomach and lungs to the plants that support them, and the experiment may be easily performed, and ocular demonstration will convince them that it is not for the benefit of any crop to be partially denuded of its leaves. The experiment may be tried by selecting two plants as nearly alike as possible, or it may be a few feet or yards of two drills. Let the plant, or lot of plants selected, be from time to time deprived of some of their leaves—that is to say, of such a quantity as is generally taken when used for the feeding of cattle; let another lot remain undisturbed, and let the one be weighed against the other at the time of lifting the roots, and the difference will be soon ascertained.

Before concluding, we may remark, that such plants as are intended for transplanting should not remain too long in the seed-bed in which they may first start into existence; for when allowed to remain too long, especially such plants as are grown for their roots, they get into a ligneous state when grown too thick, and permitted to remain past the proper time of transplanting; they are not able, it would appear, to recover that tender and succulent state which they ought to possess in order to arrive at the bulk which many of them reach. For example, we transplanted a number of Swedish turnips, at what we considered a proper time. They grew well, and gave at the rate of 30 tons per acre, from the same seed-bed; but about three weeks or a month later, another quantity was drawn and put into similar soil with the first; they were larger plants than the first, but firmer and woody; they took with the ground well enough, but never swelled properly, and when weighed, at the same time when the first transplanted ones were, gave only at the rate of 9 tons 14 cwt. per acre.

Mangel-wurzel may also be grown on a small scale with

advantage, as well as by the farmer on a more extended surface. Cottagers and others may plant some rows of it in their garden for the use of the family and the pigs. In Scotland, where oatmeal porridge and milk are the breakfasts and suppers of thousands, the want of the latter article is often much felt in winter, and many have to go without it; others try to find a substitute in small-beer or treacle-ale. We are informed that a better article may be obtained from mangel-wurzel. Among the miscellaneous notices in the "Quarterly Journal of Agriculture for 1832," a method is given how ale may be easily made from that root. The writer says:—"From seeing an article in a newspaper describing how good a beverage might be produced from the mangel-wurzel, I have made a number of experiments, and have at length completely succeeded. It was stated, that a portion of about ten pounds of the root to a gallon would make a good liquor. *Our* method is first to wash and clean the roots well, take off the top completely, scrape (rather pare) off the outer rind, slice and boil them until soft and pulpy, squeeze the liquor from the pulp as much as possible, and then boil it again with about six ounces of hops to nine gallons, and work with yeast in the usual way. Thus, a cottager, by boiling his pot over his winter fire of a night, and using the root as we have described, might seldom be without a refreshing beverage, even the greater part of the year, for the roots may be kept in a cool place, in a proper state for use, during most of the winter."

Many who were in the habit of keeping pigs have now to part with them, since the potatoes have failed; but they might feed them still by growing mangel-wurzel. The following table shows the analysis of mangel-wurzel and turnips, and their comparative feeding properties:—

ROOTS.	QUANTITY OF NUTRITIVE MATTER IN 1000 PARTS.				
SPECIES.	Mucilage or Starch.	Saccharine Matter or Sugar.	Gluten or Albumen.	Extract.	Total Soluble or Nutritive Matter.
Swedish Turnip, . .	9	51	2	2	64
White Turnip, . . .	7	34	1	...	42
Mangel-Wurzel, .	13	119	4	...	136
Orange Globe, . . .	25¾	106¾	1.20	less than 1	135¼
Sugar Beet, ...	17¾	126¾	1¼		146¾

The turnips are by Davy, and the others by Herepath.

The following table shows the results of my experiments at one view:—

MANGEL WURZEL.	Per Acre. Tons.	Cwt.
1. Seed sown in garden soil, produced . .	28	...
2. Leaves, ...	5	...
3. Seed sown in peaty soil, ...	22	4
4. Transplanted into light soil—part of it removed,	13	...
5. Transplanted into light soil—not removed, .	18	...
6. Transplanted into stiff soil—part of it removed,	11	7
7. Transplanted into stiff soil—earth not removed,	11	2
8. Transplanted into peaty soil after early potatoes,	13	...
SWEDISH TURNIPS.		
9. Early transplanting, ...	30	...
10. Late transplanting, ...	9	14

Fir Wood for Stobs. By Mr PETER MACKENZIE.—It has been asserted that young trees used for fencing, such as palings, if put into the ground in the opposite way in which they have grown, would remain much longer in a sound state than if put in the usual way, with the small end downwards. A fence was put up some years ago, consisting chiefly of the best parts of Scotch fir-trees; the trees being about twenty years old. From the nature of the fence, it was required that the thick ends of about half of the stobs should be out of the ground, and the other half in it. There were about sixteen hundred altogether, and I have frequently examined them from time to time, and found little or no difference between them. They have not all decayed alike in either case, and this is what might have been expected, for they have not all the same quantity of resin in their composition, and those which would imbibe the greatest quantity of moisture into their inside would be the first to decay, when all were equally exposed to the vicissitudes of the weather.

While on this subject, a hint or two may be of some service to those who use the thinnings of plantations for fences of a temporary nature, or where young hedges are planted that require protection from cattle grazing in the neighbourhood.

It is a well-known fact, that pine wood when embalmed in its own fat will last for ages, and many instances are recorded of its durability since the days of Virgil's Amazonian combat, where it is recorded—

> "——cujus assertam
> Adversum longa transverberat abiete pectus."

But it is more in accordance with the spirit of our agricultural age to turn spears into paling stobs, and it may be of some advantage to proprietors and farmers to know how these may be preserved longer than they commonly are. The plan is not a new one; but perhaps it made its appearance too soon, for a knowledge of such things was not so generally spoken of about thirty or forty years ago as they are at the present day.

In an article by Mr Knight, on the "Inverted action of the albuminous vessels of trees," he says—

I have in my possession a piece of fir-tree, from which a portion of bark extending round its whole stem, had been taken off several years before the tree was felled, and of this portion of wood, one grew above and the other below the decorticated space. Conceiving that the wood above the decorticated space ought to be much heavier than that below it, owing to the stagnation of the descending sap, I ascertained the specific gravity of both kinds, taking a wedge of each as nearly of the same form as I could obtain, and I found the difference greatly more than I had anticipated; the specific gravity of the wood above the decorticated space being 0.590, and of that below only 0.491; and having steeped pieces of each which weighed a hundred grains during twelve hours in water, I found the latter had absorbed 69 grains, and the former only 51.

The increased solidity of the wood above the decorticated space, in this instance, must I conceive have arisen from the stagnation of the true sap in its descent from the leaves; and therefore, in felling firs or other resinous trees, considerable advantages may be expected from stripping off a portion of their bark all round their trunk, close to the surface of the ground, about the end of May or beginning of June, in the summer preceding the autumn in which they are to be felled. For much of the resinous matter contained in the roots of these is probably carried up by the ascending sap in the spring, and the return of a large portion of this matter to the roots would probably be prevented. The timber, I have however very little doubt, would be much improved by standing a second year, and being then felled in the autumn; but some loss would be sustained owing to the slow growth of the trees in the second summer. The albumen of other trees might, probably, be rendered more solid and durable by the same process; but the descending sap of these being of a more fluid consistence than that of the resinous tribe, would escape through the decorticated space into the roots in much larger quantity.

When plantations require thinning, a person accustomed to pruning and thinning will be able to tell, a year before, which trees will require to be cut; and it would not require much time to prepare the trees as recommended by Knight. It has been found advantageous to treat the larch in a somewhat similar way, so that the white wood is as good as the rest of the tree. In confirmation of Knight's views, I may state the following circumstance:—About ten or twelve years ago, a larch-tree had part of its bark taken off in the summer season in the following manner. About five feet from the ground, an incision was made round the tree, and another at the bottom; afterwards the bark was stripped off, and the tree allowed to remain in that state until the next year. The tree was about four and a half inches in diameter, five feet from the ground. It has been exposed to the weather

ever since it has been cut down, and it is used as a post, and the part first deprived of its bark is left out of the ground, along with another part that had the bark on, a year longer. The under part is still fresh and good, but it wants the hardness of the upper part, which has more of the nature of hard-wood than the sap-wood of one year. We would consider five feet by far too much of a decorticated space to be left where the increased solidity of the wood is wanted; perhaps half a foot, or less, at the bottom of the tree is quite sufficient for the purpose.

Burnett's Farmers' Cycle.—This is a table printed on a card which will be found very useful by all breeders of stock. It consists of an outer circle, containing the months and days of the year, and of an inner one, moveable on a centre, containing one pointer, which, when placed at any one day of the year, adjusts three other pointers which respectively indicate the period when a cow should calve, a ewe lamb, and a sow farrow. Such a table at hand, saves the trouble of calculating the recurrence of those important events on a farm, in order to their insertion in the book of reckonings, which every farmer of course, but every shepherd and cattle-man should possess. The period of gestation assumed of the cow is 280 days, of the ewe 148 days, and of the sow 112 days.

Cropping Fallows. By the late Mr MAIN, Chelsea.—Fallowing arable land for the purpose of ameliorating or clearing of weeds, or resting it for a few years after a course of severe cropping, are two of the oldest practices incident to field husbandry. In the early history of the Jewish nation, we learn that resting the arable land at stated periods was enjoined by their legislature; and ever since, the same customs have been followed in every modern system of agriculture, except in such populous countries as China, where no weeds are suffered to grow at any time, or as in certain districts of high-rented land in this country, where continual hand-weeding of every crop checks the increase of weeds, and renders summer fallows unnecessary, as is exemplified in the large market garden farms in the neighbourhood of London, where every plough and harrow are followed by a troop of women and children who pick up every root-weed they can find. Weeds naturally arise in every crop, and, if not destroyed, increase in number in every following one, till at last they gain possession of the whole surface; in which case a fallow is the only remedy. On the other hand, if land has been exhausted by long and repeated annual cropping, it is recruited by being laid down to pasture for a few years, in order to be again broken up at a suitable time. On

this practice of having land alternately under the plough and pasture, the system of convertible husbandry is founded; and is unluckily less practised than it deserves to be.

Fallowing, therefore, though in most cases absolutely necessary, is always regretted, because the process is expense without immediate profit; and when a fallow on light soil is extended for wheat to be sown at Michaelmas, the purpose of the fallow is completed; that is, the soil is sufficiently reduced, the weeds destroyed, burnt, or got off by the first of June, after which the land must lie naked till wheat seed-time. It was this circumstance, in all probability, which first suggested the idea of raising an intermediate crop on the naked fallow. Any plant which would arrive at an useful degree of perfection in the space of four months, would be of great importance to the live-stock farmer, and at the same time prevent the naked soil from being parched and impoverished by the heat of the midsummer sun. The clovers and their alliances were recommended, as well as several of the grasses; but the turnip and its congeries were found the most eligible, whether to be eaten or drawn off before wheat sowing, or to stand over the winter to be eaten off in the spring. The introduction of the turnip upon the fallows formed quite an era in British farming; so satisfactory was every trial of raising turnips on the fallow, that hardly any other kind of plant was thought of as a substitute.

This predilection for the turnip, in a very short time produced a very material change in the general system of farming. It introduced the *four course* rotation of cropping over all the lighter descriptions of land in the kingdom; and of course the general practice became much more uniform and successful. But this uniformity of culture, and constantly recurring crops of the same kinds upon the same fields, began to show, that there was not a sufficient variety of plants in the rotation. Some of them exhibited unusual weakness. Broad clover was one of the first that gave signs of being tired of land where it had often been grown before; wheat appears to be less abundant than formerly; and even the turnip itself presents signs of decrepitude.

These failures can only be attributed to the too frequent repetition of the same crops on the same fields; the attention of farmers has been awakened to the subject, and it is matter of serious consideration with every thinking man, how far our present management of free soils, as respects the rotation of the crops, may be improved by the introduction of new plants, and to which the land would be a congenial bed—that is, not already tired.

Such additions can only be pasture or fodder plants, either of

which would be a valuable boon to the live-stock farmer, or to any one wishing to increase his live-stock. Because, according to the number of the flocks and herds that can be well kept throughout the year on any farm, in like proportion will be the amount of profits arising therefrom. Any crop, therefore, that can be raised upon a fallow, between the first of June and wheat seed-time, say before the middle of October, will be so much clear gain; and, what is of equal importance, the land itself will be less exhausted by bearing a green shady crop, than it would be lying idle for two or three months, exposed to a parching sun.

On some of the light gravelly soils in the south of England, and where the fallowing is soon completed, the farmers have a custom of sowing brank to shade the land, and as a preparation for wheat. This plant is so rapid in growth, and so quickly arrives at perfection, that though a native of India, it may be successfully cultivated in Siberia, where the summer continues only three months; if sown, therefore, in the beginning of June in this country, the crop is usually in the barn or rickyard some time in October. The straw is of no use as fodder, and makes but poor litter, the whole plant being so succulent, that it is quickly decomposed, whether in the earth or air. The plant is most impatient of frost, the least degree being fatal to it during growth. In favourable seasons, however, it yields three or four quarters of grain per acre, the price varying with that of barley, and is eagerly purchased by distillers.

But there is another much more useful fodder plant, which may be raised on a wheat fallow, and within the same period as is required for brank, namely, three or four months; and to recommend which to the notice of live-stock farmers, is the principal object of this communication.

This plant is no other than the common trefoil, which when the fallow is completed early, say beginning of June, let a liberal quantity, (8 or 10 lbs per acre,) be sown on a well pulverised surface, tined in, and rolled down smooth. If the soil be somewhat moist, or soon afterward refreshed with showers, the plants will quickly appear and cover the ground, and be ready to fold off in good time.

A friend of mine, a most intelligent and successful farmer and grazier in Essex, has this last summer tried for the first time the trefoil at my instigation. A few days ago, I requested to know how it turned out; his answer now before me is in the following words:—"The weather was so very dry, I did not sow till the third week in June, and I think we had no rain till quite the latter end of that month. Soon afterwards, the plants came up and flourished quite equal to my expectation, and afforded abun-

dant keep both for beasts and sheep; and, moreover, formed a firm and wholesome seed-bed for the wheat, in a field which was always before too light for wheat after a fallow."

Here, then, we have proof that, when light land requires a fallow for wheat, a kindly preparation may be made for it by taking an immediately previous crop of trefoil, which is so much gain by saving other provender, advancing the condition of the stock, and, as already observed, improving the staple for the reception of the wheat-seed. I know of no other plant that would equally answer the purpose of the farmer as trefoil. Tankard turnips, indeed, might be tried before wheat; but they are a more expensive and more casualty crop than trefoil.

The introduction of the greatest variety of useful plants into our rotations of crops is a positive advantage. It is well known that plants of different genera succeed each other on the same spot much more prosperously than if they were nearly allied; and, therefore, whenever a useful green crop can be taken from between two white ones, all three will be benefited. This, indeed, is a general rule among cultivators, and it is a practice which can hardly be carried too far. The foregoing account of the success of trefoil is one instance of how any rotation may be occasionally varied with advantage; and it is a practical point of cultivation which should engage attention much more than it has hitherto done.

Every addition that can possibly be made to the amount of fodder upon a farm, is, in the present state of British agriculture, of most material consequence to the farmer. Less ploughing, except for green crops, and more feeding, should be a guiding principle. The butcher and cattle-dealer would be better customers than the miller and corn-merchant. With the former we have few or no rivals; but with the latter both Europe and America are in league against us, or at least their threatened rivalry should not be disregarded.

The Guano Trade.—The following remarks on the guano trade are taken from the annual circular issued by Messrs William Connall and Co., of Glasgow :—

Early in the year, the attention of capitalists was directed to this article, and prices for good Ichaboe, in cargoes, rose from L.6, 5s. to L.7, 15s. per ton. As the season advanced, however, supplies, from various places of deposit on the African coast, continued to pour in; and, though that at Ichaboe was exhausted, it gradually receded in value till July, when it was held nominally at L.5, 5s. to L.5, 10s.; but the greater eligibility, as a manure, of Ichaboe to all but Peruvian guano, led to considerable transactions during the autumn, at L.7, 5s. to L.7, 10s., in cargoes, which may be considered its present value, whilst other descriptions range from L.5 to L.6. No estimate can be formed of the annual consumption throughout Scotland, the demand having been met along the whole line of the east and west coast by direct importation into almost every port, more or less

connected with the shipping interest, which diminished the pressure on the stock in this quarter as compared with the season of 1844, when prices were driven up from L.9 to L.12 per ton. The experience of the last few months in the failure of the various expeditions in quest of guano and nitrate of soda has confirmed the impression, that no new deposits have been found since the discovery of those at Saldanha Bay and Colooney Island; and this, taken in connexion with the anticipated spring demand, the increasing exportation to the West Indies, the fact of one-fourth of the stock being of inferior qualities, and of at least fully more than the same proportion, consisting of Ichaboe, being in the hands of a few capitalists, may render the annexed statistics the more interesting, being actual returns from the undernoted places:—

Estimated Stock of Guano in the Ports of Scotland.

	Peruvian.	Ichaboe.	Saldanha Bay, Colooney Isld. Bird Island. Eliz. Bay, &c.
Inverness, Invergordon, Findhorn, Nairn, Lossie, Burghead, Port-Gordon, Banff, Macduff, Fraserburgh, Portsoy, Peterhead, Stonehaven, Gourdon, St Andrews, Arbroath, and Kirkaldy	40	2259	840
Newburgh	200	430	310
Aberdeen	180	2683	1300
Montrose	10	550	357
Dundee, including Ferry Port-on-Craig	...	3900	1640
Alloa, Grangemouth, Bo'ness, North Berwick, Aberlady, Cockenzie, Dunbar, Eyemouth, and Berwick	400	1600	525
Leith and Fisherrow	1100	5400	2650
Stranraer, Troon, Girvan, Saltcoats, Ardrossan, and Dumbarton	10	616	75
Dumfries	...	845	400
Ayr	380	1200	365
Greenock and Port Glasgow	...	8895	475
Glasgow	1050	12,800	1500
	3370	41,178	13,437
Total stock	57,985 tons.		

"The following is a statement of stock in Liverpool on 1st January 1846:—

South American, . . .	14,000 Tons
Ichaboe, ...	48,068 ...
Other African, ...	18,105 ...
Tons, . . .	80,173

The market is firm: L.10 the price of Peruvian; L.7, 15s. best Ichaboe; and for Saldanha Bay, &c., L.4, 10s. to L.6."

Smithfield Market.—It would seem, from this unmitigated nuisance having been so long tolerated in the very heart of the city of London, that the citizens delight to have it there. They

cannot be ignorant of the great source of danger to travellers, whether on foot or in vehicle, is every drove of cattle and sheep they may happen to meet in the numerous narrow streets leading to Smithfield, and they must have witnessed many injuries the poor animals are doomed to suffer on being driven to and from the market. Neither the citizens nor the Corporation can be ignorant of the existence of those evils, and yet they are suffered by both parties to be repeated twice every week.

An attempt was made, some years since, by the Society for the Suppression of Cruelty to Animals, to induce the Corporation either to remove the market to a more accessible situation, or to abate much of the ill usage befalling the poor animals exposed for sale, literally for want of room. Of the state of the animals any one may judge from the fact, that the space occupied by the cattle and sheep now is not larger than when the population of the city and the suburbs was not above half of what it is, and when of course the consumption of butcher meat was comparatively small. The Corporation, however, is much too powerful a body to allow its interests to be affected by any association of individuals; and as they allege that a large revenue would be lost to the city were the stock market removed from Smithfield, it is not at all probable that they will soon agree to its removal; and the citizens themselves are quite apathetic on the subject. It is certain that the abolition of the market would cause a loss of revenue; but might that not be compensated by a revenue derived from other sources, such as the conversion of Smithfield, for example, into a general central terminus for all the railways connected with London?

Since this is the state of matters after the many remonstrances which have been made at home, it is not likely that the expression of the opinion of foreigners on the subject will have any effect in drawing the attention of the Corporation to the market as a nuisance to human beings, and a source of much suffering to animals —to those very animals which are brought thither for the express purpose of forming a large proportion of the food to be consumed by those who are witnesses of those sufferings.

Le Cultivateur, a Parisian agricultural monthly journal for July 1846, contains a report of a commission sent by the Prefect of the Seine last year to England, Belgium, Holland, and Prussia, to investigate into the constitution and condition of our public markets, and they thus speak of Smithfield after visiting it:—

This cattle-market, say they, as every stranger knows who has visited England, is held twice a-week, on Monday and Friday, in the midst of one of the most populous quarters of London, and in an irregular square, from which diverge narrow and much-frequented streets. Smithfield is the *beau-ideal* of dis-

order occasioned in markets—the driving out of the cattle sold, the taking away of the flocks of sheep, the affrighted state of the animals which escape, the barking of the dogs, the shouts of the drovers, all these produce the most frightful rackets that can be heard, and the most tumultuous movements that can be seen. It is not always prudent for the passer-by or the curious to engage his attention for a moment to the most interesting bargain. Add to this, that the streets in the neighbourhood, which are the way to the slaughter-houses in Newgate, a principal market for meat, and to the sheds which accommodate the unsold stock, are crowded by animals, and so dirtied by their dung, that the foot of the passenger cannot avoid it. They do not scruple to open the Royal Parks in London to the sheep to be driven to Smithfield; and it is on this account that numerous flocks are seen pasturing the beautiful green turf of the Regent's Park.

The arrangement of the market at Smithfield is then far from offering the accommodation afforded at Sceaux and Poissy, yet the sales which are effected there much surpass those of our two great cattle-markets, as shown by these results relating to the year 1842:—

	Oxen and Cows.		Sheep.		Calves,		Pigs.
Smithfield,		169,995		1,707,196		30,489	30,000
Poissy, .	77,847		301,436		32,283		—
Sceaux, .	54,621		381,334		13,068		—
Paris, . .	9,940	142,408	14	682,784	49,012	94,363	—
		17,587		1,024,412		63,874	

Thus exceeding in oxen by one-fourth, and more than double of sheep.

This is the difference of the consumption of butcher-meat in the two countries:—

In England, for every person per annum, the consumption is thus:—

A rich family in London, consisting of husband, wife, six children, and ten servants.	370[illegible] lb.
A house of business in which there are 114 persons of both sexes,	$306\frac{18}{20}$ ...
An hospital containing at least 290 children of both sexes, and where food is not given at discretion, . . .	160 ...
The mean is,	$279\frac{1}{20}$ ...
In France, it has been ascertained that the mean annual consumption of a family in Paris, which in 1789 was estimated at 148lb., was no more from 182 to 1837 than . . .	$107\frac{4}{20}$ ...
Making the mean annual consumption of a London family exceed that of one in Paris by	$171\frac{17}{20}$ ...

In beef, mutton, and pork, the consumption of London much exceeds that of Paris; but in the delicate article of veal, Paris consumes no less than 63,874 more calves in the year than London; and we have no doubt, were the fact ascertained, the consumption of eggs and poultry in Paris would also much exceed that of London. In fact every species of *white* meat, as the delicate kinds of flesh-food are called, is highly relished by the French.

AGRICULTURAL REPORT.

December 1846.

Unlike in its usual character, October this season was rainy and stormy. The ground became so wet that the nicer operations of the field, such as wheat sowing and turnip storing, could not with propriety be prosecuted.

November, too, assumed a different character from its ordinary one; instead of the dull, drizzly, and foggy, it was the sunny, the cheerful, and dry. Indeed, October and November seemed to have exchanged characters. The immediate consequence was, that the wheat which ought to have been sown in October, could not be safely placed in the ground until November. In the south of England—a paradise *for* farmers, though not *of* farmers—the wheat was put into the ground in October in an excellent state.

December also has thought proper to assume a change of character, from the rainy, cloudy, and disagreeable, to the sharp, clear, and frosty. The frost *felt* excessively keen, though we never observed the barometer below 30° Fahr. in the daytime.

We are seldom visited by a snow-storm before the new-year. Amongst the other anomalies of this peculiar and memorable season, our hills were partially covered with snow in October; and in December such a heavy fall occurred in some parts of the country, as to have had no parallel since 1838. The fall seems to have formed two zones across the country; one, the heavier, in England, from the Tweed to Derby; the other, along the Grampian range, the northern face receiving the storm most heavily. The storm came from the north-east, and of course across the German Ocean; and what seems a remarkable freak practised by it, it left a zone of country almost untouched with snow, from the Tweed to the Grampians. The mails were retarded in their progress towards Edinburgh from London on the one hand, and Inverness on the other.

The rapid and simultaneous ripening of the crops of grain completely overtook this season the preparation of the fallows for wheat; so that, contrary to ordinary practice, very little of that grain was committed to the ground until the harvest work was entirely finished; and even thereafter, the heavy rain of October rendered the ground, when prepared, in an unfit state for the action of the harrows. Had not November proved auspicious, contrary to the usual expectation, the autumnal wheat sowing would have been conducted this season in unfavourable circumstances; although it must be owned, that a damp bed in no way injures the germination and growth of the young wheat plant.

We remember, one year, of having to finish five acres of a field with autumn wheat, and, while so engaged, was overtaken with so heavy a rain, that it literally ran down the back of the sower, and caused the harrows to *trail* the ground. Though the work was of course imperfectly finished, those five acres bore at harvest by far the best crop of the field.

The young wheat, though late, looked fresh and gay before the severe frost.

The pastures have continued good to the latest period of the season.

The dreaded rot amongst the turnips did not occur. The Swedes which were patched up with white turnips could not of course attain to a full crop. The mildew was washed off by the rains of October; but, on the other hand, the heavy rains then, accompanied with a gloomy and stormy atmosphere, prevented the bulbs swelling to the usual size in that most favourable month of the year for that desirable process. November, however, in this as in wheat-sowing, rendered essential service; so that, during that month, the bulbs enlarged progressively in size, until vegetation was effectually checked by the severe frost of December. We have not heard any particulars of the feeding power of the turnips this season, but perceive that the ground is too quickly cleared of the crop. The aftermath of grass being available to so late a period, would probably defer the consumption of the turnip for a few weeks.

One other fact regarding the disease of the potato, has been established since this year's crop was taken out of the ground; namely, that the premature death of the haulm does not necessarily imply disease in the root. The early destruction of the haulm over the whole country, when it was in the greatest vigour of growth, more vigorous indeed than for some years past, naturally created an apprehension of the destruction of the whole crop. Hence arose the cry of famine in the land, and its dreaded consequences. It is known that a large proportion of the people depend on the potato for their daily subsistence; and when that crop was supposed to be entirely annihilated by disease, the inevitable consequence would be the perishing of many for want of food, were means not used to award off the dire calamity in obtaining other kinds of food, and distributing them in charity, and in return for labour.

Like all matters creating public alarm, the extent of the failure of the potato crop was exaggerated. Indeed, man knowing the Supreme benevolence which always actuates the dealings of Providence with him, it was unreasonable—it was impious—to imagine, even for a moment, that any species of crop, upon which any number of the human race subsisted, would be destroyed at

once and entirely. From the decayed state of the stems, some farmers, wise in economy, had determined not to superadd expense to their loss in taking up a worthless crop; but such a resolution could not be put into practice, as the smallest potato will grow, and produce a plant which would constitute a troublesome, because a strong-rooted, weed in the ensuing crop of grain. The crop, such as it was, had to be taken up, and though its return was scanty, not perhaps one-tenth part in the neighbourhood of large towns, where the land is very highly manured; yet in most parts of the country the yield was perhaps not less than one-fourth, while in some places a half crop was obtained, from some varieties, such as the cups. Yorkshire seems to have escaped the disease more than other countries, and the potatoes imported from thence into Edinburgh are of good quality, realizing of course a high price, 13d. and 14d. the peck. Confidence in the culture of the potato being now entirely lost, we apprehend that a long period will elapse ere that plant will form a prominent feature in our fields. For this season, at least, the crop is not regarded as a constituent of human food; most farmers being content to collect as much as will serve for seed to raise a crop for their home consumption next year.

The October Tryst of Falkirk was well attended by cattle and sheep, though many of the prime lots were picked up on the road, and in the country, by English dealers. The prices were high. At All-Hallow Fair at Edinburgh, in November, there was an unusual scarcity of North and West Highland cattle, such as are generally in request by south country farmers for wintering, and, consequently, many such buyers were disappointed, and returned home unprovided. They were not disposed to give large prices for cattle that did not suit their taste in the prospect of rather a short crop of turnips. They might, however, afterwards supply themselves with half-bred beasts at Alnwick and Newcastle. There was a much greater than usual quantity of Ayrshire-looking beasts at All-Hallow, which the south country farmers did not seem to like; and, in consequence, such beasts had to stand the market next day, and be there disposed of at a comparatively low price, or walk off to some other market.

The deficiency in the potato crop has caused great activity in the grain market. The early alarm created about that event prompted the foreign exporters of grain to send as large a supply as they could; and, considering the intensity of that alarm, the prices of grain are not so high as might be expected. Wheat, on the 12th December 1845, was 59s. 4d. per quarter, and on the 12th December 1846, it was no more than 60s. 3d., and the aggregate average of the six preceding weeks is 60s. 4d. To produce such a parity of price our crop of this year must either

be better than the one of last, or the importations of foreign corn must have been very extensive. The quantities in bond at that period and this of course form no criterion of the quantities imported—the wheat in bond in the kingdom on the 5th November 1845, having been 667,713 quarters, and of flour 278,683 cwt.; while, on the 5th November 1846, the wheat was only 114,989 quarters, and flour 257,985 cwt.—because at that period the duty being 20s., and now only 4s. per quarter, the temptation to bond has been removed. The importation therefore may have been extensive; we have heard it stated at 3,000,000 quarters of all sorts of grain, flour, and meal. Still, if our own crop of wheat had not been good and nutritious, the prices would have been higher in despite of so large importations. And, besides, although the exporters have sent large quantities, they retain them in their own granaries here, paying the low duty in the mean time, in the confident expectation, no doubt, of the prices rising considerably as the season advances. As matters stand, we have no doubt the exporters are disappointed at present prices; and whether they will realize greater when the spring arrives, will entirely depend on the supply obtained from America, which may be expected to be ample, as the crop is represented to have been a great one throughout all America. We observe that Indian corn is now so scarce as to realize a price of 68s. a quarter. Of the anticipated importations from America, we hope that Indian corn will form a large proportion, that being a species of grain which might profitably be employed as food for stock, and as a substitution for that purpose far superior to the potato itself.

Sumultaneous movements at present are making for the repeal of both the tea-duty and the malt-tax. The revenue derived from them is about equal. Of the two, however, we would decidedly give the preference to the abolition of the malt-tax, as a measure much more adapted to comfort and support the people, than any quantity of tea they could drink. But, independently of this view, the possibility of getting rid of the troublesome interference of excise regulations in a useful ingredient in the feeding of cattle, and the concocting of a wholesome beverage for domestic consumption, should at once demonstrate to the Legislature that the remission of the malt-tax would be a greater boon to the country at large, than even a large reduction in the duty on tea.

TABLE OF PRICES, &c.

erage Prices of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets :—

LONDON.

	Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Rye. s.	d.	Pease. s.	d.	Beans. s.	d.
.	57	0	29	0	23	2	35	0	42	11	40	4
.	54	11	33	9	25	5	33	9	39	5	42	0
.	54	7	30	8	25	8	36	7	50	3	44	1
.	58	6	40	7	26	2	37	4	50	9	46	4
.	60	2	39	7	25	4	37	8	54	8	45	3
.	61	4	39	3	25	6	38	5	55	10	42	11
.	64	3	41	5	27	2	39	0	52	2	44	8
.	68	5	42	8	28	1	42	5	55	0	45	5
.	67	3	46	4	28	7	43	4	58	0	45	4
.	68	10	47	7	28	6	46	0	58	6	45	9
.	66	10	46	2	27	9	43	0	54	1	47	6
.	65	7	44	11	26	6	46	0	56	3	46	2
.	63	9	46	8	27	6	46	2	50	0	45	9

LIVERPOOL.

	Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Rye. s.	d.	Pease. s.	d.	Beans. s.	d.
.	50	9	32	8	26	3	32	6	46	6	44	6
.	49	0	33	0	27	11	33	2	47	4	42	3
.	52	0	35	0	23	1	33	8	41	5	43	9
.	51	3	34	2	23	0	33	0	49	0	45	4
.	53	7	32	5	28	7	33	6	49	6	47	5
.	56	10	34	2	28	3	34	6	52	4	44	11
.	56	0	41	3	28	1	35	4	60	0	50	1
.	58	0	38	0	28	8	36	8	60	7	48	11
.	59	7	33	10	27	4	38	8	49	3	47	6
.	61	1	45	3	31	9	39	6	55	8	48	0
.	59	1	44	2	30	11	40	6	47	6	49	3
.	59	7	40	4	31	0	41	6	48	2	52	1
.	57	8	38	4	31	4	40	10	42	10	48	6

EDINBURGH.

Date.	Wheat. s.	d.	Barley. s.	d.	Oats. s.	d.	Pease. s.	d.	Beans. s.	d.
1846.										
Sept. 2.	64	2	37	0	36	0	48	0	50	0
9.	68	0	40	0	36	8	46	0	47	6
16.	73	0	41	0	35	4	46	6	48	0
23.	74	6	40	0	35	6	48	0	52	0
30.	63	6	37	0	30	6	49	6	50	6
Oct. 7.	66	4	37	8	31	4	50	6	52	4
14.	66	9	38	6	37	4	50	8	52	0
21.	63	0	39	2	31	9	48	0	49	2
28.	63	3	44	0	34	8	52	0	53	0
Nov. 4.	63	0	37	9	30	5	48	0	49	0
11.	60	0	37	6	29	10	55	6	57	2
18.	59	2	37	8	29	11	50	0	50	6
25.	57	8	37	7	29	5	49	0	50	2

DUBLIN.

Date.	Wheat, per bar. 20 st. s.	d.	Barley, per bar. 16 st. s.	d.	Bear, per bar. 16 st. s.	d.	Oats, per bar. 14 st. s.	d.	Flour, per bar. 9 st. s.	d.
1846.										
Sept. 4.	29	1	17	6	14	9	15	11	17	6
11.	31	1	17	8	15	10	17	7	18	0
18.	30	2	17	10	17	5	16	6	19	0
25.	30	9	18	1	18	6	15	4	19	6
Oct. 2.	33	0	18	4	19	11	15	2	21	0
9.	34	9	18	5	20	1	15	11	21	5
16.	35	3	18	10	19	0	16	4	22	0
23.	36	9	18	3	18	9	16	11	22	2
30.	35	6	18	6	18	6	17	1	21	8
Nov. 6.	35	4	18	8	18	4	17	4	22	0
13.	35	2	18	10	18	2	17	0	21	9
20.	35	9	18	6	18	0	17	8	22	0
27.	36	6	21	10	22	4	18	5	22	6

E showing the Weekly Average Price of GRAIN, made up in terms of 7th and 8th Geo. c. 58, and 5th Vict., c. 14, and the Aggregate Averages which regulate the Duties pay- n FOREIGN CORN: the Duties payable thereon, from September to December 1846.

Wheat. Weekly Average. s.	d.	Aggreg. Average. s.	d.	Duty. s.	d.	Barley. Weekly Average. s.	d.	Aggreg. Average. s.	d.	Duty. s.	d.	Oats. Weekly Average. s.	d.	Aggreg. Average. s.	d.	Duty. s.	d.	Rye. Weekly Average. s.	d.	Aggreg. Average. s.	d.	Duty. s.	d.	Pease. Weekly Average. s.	d.	Aggreg. Average. s.	d.	Duty. s.	d.	Beans. Weekly Average. s.	d.	Aggreg. Average. s.	d.	Duty. s.	d.
49	0	46	9	10	0	31	0	28	1	3	6	23	2	23	4	1	6	32	7	30	7	3	6	37	1	36	7	3	0	40	4	39	8	3	6
50	0	47	2	10	0	33	7	29	2	3	0	23	5	23	4	1	6	32	4	31	4	3	0	38	10	37	1	3	0	40	11	40	0	3	0
51	3	48	2	9	0	36	1	30	9	2	6	23	7	23	5	1	6	33	0	31	10	3	0	40	5	37	11	2	6	41	6	40	4	2	6
53	1	49	6	8	0	36	10	32	4	2	6	21	8	23	4	1	6	35	7	32	8	2	0	45	0	39	5	2	0	42	7	40	10	2	0
54	0	50	11	7	0	36	9	33	11	2	6	24	3	23	7	1	6	35	5	33	5	1	6	45	4	40	10	2	0	43	4	41	5	2	0
56	10	52	4	5	0	37	2	35	3	2	0	24	7	23	9	1	6	35	9	34	1	2	0	46	7	42	2	2	0	43	7	42	1	2	0
59	10	54	2	4	0	38	8	36	6	2	0	25	8	24	2	1	6	38	3	35	0	2	0	47	3	43	11	2	0	45	5	42	11	2	0
60	10	56	0	4	0	40	2	37	7	2	0	26	6	24	8	1	6	39	0	36	2	2	0	48	10	45	7	2	0	45	9	43	8	2	0
61	9	57	9	4	0	41	8	38	6	2	0	27	0	26	0	1	6	41	1	37	2	2	0	50	8	47	3	2	0	46	1	44	6	2	0
62	3	59	3	4	0	44	3	39	9	2	0	27	3	25	10	1	6	41	6	38	6	2	0	50	11	49	3	2	0	46	6	45	1	2	0
61	5	60	6	4	0	44	6	41	1	2	0	26	9	26	3	1	6	42	4	39	8	2	0	50	10	49	2	2	0	46	10	45	8	2	0
59	8	60	11	4	0	42	11	42	0	2	0	25	10	26	6	1	6	42	7	40	9	2	0	49	0	49	7	2	0	46	4	46	2	2	0
59	0	60	10	4	0	42	9	42	8	2	0	25	11	26	7	1	6	44	2	41	9	2	0	47	6	49	6	2	0	45	10	46	3	2	0

FOREIGN MARKETS, per Imperial Quarter, free on board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1846.							
Sept.	Danzig.	44/ to 52/	26/6 to 35/6	16/ to 22/	32/ to 36/	32/ to 36/	30/ to 34/6
Oct.	......	53/ . 58/6	29/ . 38/6	17/6 . 22/6	34/6 . 41/	36/6 . 48/	36/ . 42/
Nov.	......	50/ . 56/	28/ . 35/6	16/6 . 21/6	33/6 . 40/	36/ . 46/	34/ . 40/6
Sept.	Hamburg.	46/6 . 51/9	23/6 . 27/6	16/6 . 21/9	32/6 . 36/6	30/6 . 35/	30/ . 34/6
Oct.	......	48/6 . 52/6	25/6 . 36/6	18/6 . 22/	33/6 . 38/6	33/6 . 39/6	32/ . 42/6
Nov.	......	50/ . 57/6	28/ . 38/6	20/ . 23/6	32/ . 37/	38/ . 47/6	40/6 . 44/
Sept.	Bremen.	47/6 . 50/6	29/6 . 33/6	17/6 . 23/6	35/ . 39/	32/6 . 40/	32/ . 42/6
Oct.	......	55/6 . 63/	33/6 . 38/	18/6 . 25/6	36/6 . 52/6	38/6 . 55/	38/ . 44/
Nov.	......	60/ . 65/	31/6 . 36/6	17/ . 24/	44/ . 54/	50/ . 56/	39/ . 42/6
Sept.	Konigsberg.	42/6 . 50/	28/ . 34/6	16/6 . 24/6	36/ . 43/	42/ . 48/	40/ . 44/6
Oct.	......	46/6 . 57/	30/6 . 35/6	17/6 . 26/	40/ . 48/	46/ . 50/6	39/ . 43/6
Nov.	......	44/ . 56/6	29/ . 33/6	16/6 . 20/6	38/6 . 45/6	36/6 . 42/	38/6 . 42/6

Freight from the Baltic, from 4/6 to 7/6; and from 7/6 to 11/6 from Trieste, Alexandria, &c., to Great Britain.

THE REVENUE.

***ABSTRACT** of the Nett Produce of the Revenue of Great Britain, in the Quarters and Years ended on the 10th of October 1845, and 10th of October 1846—showing the Increase and Decrease on each head thereof.*

	Quarters ending October 10.		Increase.	Decrease.	Years ending October 10.		Increase.	Decrease.
	1845.	1846.			1845.	1846.		
Customs	£4,848,363	£5,310,835	£462,472	....	£18,652,552	£18,150,933	....	£501,619
Excise	3,955,106	4,181,926	226,829	....	12,069,215	12,251,932	£182,717	....
Stamps	1,780,175	1,774,364	....	£5,811	6,961,370	6,933,129	21,759	....
Taxes	201,279	209,940	8,661	....	4,228,281	4,238,560	10,279	....
Post-Office	209,000	217,000	8,000	....	688,000	802,000	114,000	....
Miscellaneous	495,102	450,554	....	44,548	1,047,960	1,439,548	391,588	....
Property Tax	1,823,883	1,972,128	148,245	....	5,127,126	5,332,157	205,031	....
	13,312,908	14,116,747	854,207	50,359	48,774,504	49,148,259	925,374	501,619
	Ded. decrease on Qr.		50,359	....	Deduct decrease on Yr.		501,619	....
	Increase on the Qr.		803,848	....	Increase on the Year.		423,755	....

PRICES of BUTCHER MEAT.

Date, 1846.	LONDON. Per stone of 14 lb.		LIVERPOOL. Per stone of 14 lb.		NEWCASTLE. Per stone of 14 lb.		EDINBURGH. Per stone of 14 lb.		GLASGOW. Per stone of 14 lb.	
	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.	Beef.	Mutton.
Sept.	7/3 to 7/9	7/3 to 7/6	6/6 to 7/6	6/ to 7/6	6/3 to 7/3	6/ to 7/6	6/ to 7/	6/3 to 7/6	6/6 to 7/6	6/3 to 7/6
Oct.	7/6 . 8/	7/6 . 8/	6/9 . 7/9	6/6 . 7/9	6/6 . 7/6	6/6 . 7/9	6/3 . 7/6	6/6 . 7/9	6/9 . 7/9	6/6 . 7/9
Nov.	7/9 . 8/3	7/9 . 8/3	7/ . 8/	6/9 . 8/	6/9 . 7/9	6/9 . 8/	7/3 . 7/9	7/ . 7/6	7/3 . 8/	7/ . 8/

PRICES of English and Scotch WOOL.

ENGLISH, per 14 lb.

Merino, ...	14s. 6d. to 20s. 6d.
.... in grease, . . .	11s. 0d. ... 16s. 6d.
South down, ...	14s. 6d. ... 20s. 6d.
Half-bred, ...	12s. 6d. ... 17s. 0d.
Leicester Hogg, . . .	13s. 6d. ... 20s. 0d.
.... Ewe and Hogg, .	12s. 0d. ... 17s. 0d.
Locks, ...	7s. 0d. ... 9s. 6d.
Moor, ...	0s. 0d. ... 8s. 0d.

SCOTCH, per 14 lb.

Leicester Hogg, . . .	14s. 6d. to 20s. 6d.
.... Ewe and Hogg, .	11s. 6d. ... 15s. 0d.
Cheviot, white, . . .	10s. 6d. ... 14s. 3d.
.... Laid, washed, . .	7s. 6d. ... 10s. 6d.
.... unwashed, .	6s. 3d. ... 9s. 3d.
Moor, white, ...	6s. 0d. ... 7s. 9d.
.... Laid, washed, . .	4s. 3d. ... 6s. 6d.
.... unwashed. .	3s. 6d. ... 5s. 0d.

DECISIONS IN THE SUPREME COURTS CONNECTED WITH RURAL ECONOMY.

From 12th November to 16th December 1846.

In the hope that it may prove acceptable to the readers of this *Journal*, we propose, in this and each successive Number, to insert short notices of Decisions in the Supreme Courts which may be interesting to proprietors and tenants, or which are essentially connected with rural economy. While it will be our endeavour in these notices to retain legal accuracy, we shall also, as far as possible, in the language employed, avoid legal technicality: so that, on the one hand, they may be referred to by practical agriculturists as containing correct information, and that, on the other, they may present no obstacle, in the shape of professional terms, which will not be easily surmounted by every intelligent reader. Points frequently come before the Courts for decision which are of everyday importance to the agriculturist, and upon which it cannot fail to be useful to him to be informed from time to time as they occur, in order that, in his own dealings, he may profit by the experience of others; and perhaps there is no mode in which he will be enabled more easily to acquire such a knowledge of the law, in regard to his own interests, as is now necessary to every enterprising member of society, than by having detached portions of information conveyed to him at intervals through the medium of a trustworthy periodical. Without at present tying ourselves down strictly in regard to the subjects of these notices, we may mention as some of the probable matters of interest which they will include—the respective obligations and liabilities of landlord and tenant—the construction of the various clauses in leases—the law in regard to roads, public and private—the law of master and servant—the poor-law, the game-laws, &c.; and where any case may seem to require it for elucidation, a short statement of the law, on points bearing upon the question at issue, will be added as a note.

It is perhaps scarcely necessary to caution our agricultural friends against imagining that we intend these legal notices in any case to supersede professional advice, or that we propose to encourage the practice of the delusive doctrine, of "every man his own lawyer." Our sole intention is to put unprofessional parties on their guard in cases where otherwise they might think that no difficulty existed, and to point out some of the instances in which it would be more prudent to obtain professional assistance than to act upon their own conception of the law.

We commence the series in the present number with the decisions during the winter session of 1846, and we propose, in the preparation of our notices, to make use of the reports of cases in the Court of Session and House of Lords to be found in the *Jurist*, (that being the earliest work in publication, and accurate in its information,) and of Mr Arkley's Reports of Cases in the High Court of Justiciary.

Master and Servant—Engagement of a Gamekeeper.—William Armstrong was engaged by the trustees of the late Sir John Heron Maxwell of Springkell, as gamekeeper on the estate of Springkell, at the rate of "L.11, 5s. a quarter, a house and firing, the keep of a cow summer and winter, a suit of clothes, and a cart-load of potatoes in lieu of a garden." At Whitsunday 1840, Armstrong entered upon this service, and was put in possession of a cottage. He continued therein for several years; but the mansion-house and shootings of Springkell having been subsequently let to Mr Bainbridge, who conceived that he was entitled to dismiss him without the notice usual in a yearly engagement, Armstrong was ejected from his cottage under a decree of the Sheriff of Dumfries-shire. Armstrong then brought an action against Mr Bainbridge for the recovery of a year's wages, and of damages for the loss of his perquisites, and for being unlawfully ejected from his cottage. Various allegations and pleas were set forth in the case; but the only point at present decided by the Court, was in reference to the meaning of Armstrong's original engagement with the Springkell trustees. Upon this point the Court (First Division) pronounced the following interlocutor:—"Find it admitted that, at Whitsunday 1840, the pursuer entered into the service of the trustees of the late Sir John Heron Maxwell, as gamekeeper on the estate of Springkell: Find it also admitted by the defender, that the terms upon which the pursuer had been engaged by said trustees, were at the rate of 'L.11, 5s. a quarter, a house and firing, the keep of a cow summer and winter, a suit of clothes, and a cart-load of potatoes in lieu of a garden:' Find that, unless a special contract of different endurance be established, a servant in the situation of a gamekeeper, and hired on the conditions here admitted, must be presumed to have been hired by the year, and is not to be held as a monthly servant."—*Armstrong* v. *Bainbridge*, 12*th November* 1846.—*Jurist*, vol. xix. p. 1.*

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* A grieve or farm-overseer has been held, in the absence of proof to the contrary, to have been hired for a year.—*Finlayson* v. *M'Kenzie*, 6*th June* 1829.—7 *Sh.* 717. In the case of *Mabon* v. *Elliot*, 9*th June* 1808, (*Hume's*

Landlord and Tenant—Lease under the Montgomery Act.—In 1818 the farm of Easter Kitty Muir, on the entailed estate of Raploch and Patrickholm, was let from Martinmas 1817 by the heir then in possession to Marion Hamilton, for the period of thirty-one years, under a declaration that she should "be bound to implement and fulfil the conditions of the Act of Parliament," 10 Geo. III. c. 51;* and further, that she should enclose the lands in terms of the said Act, and uphold and leave the fences in tenantable repair, and implement and fulfil the whole other clauses of the statute applicable to a lease of thirty-one years. In 1844 Mr Thomas Montgomery M'Neill Hamilton, the heir of entail now in possession, raised an action against the tenant, narrating that she had neither enclosed the land, in accordance with the terms of the lease, nor upheld the fences on the farms, but had suffered them to fall into total ruin; and concluding that she should be compelled to fulfil the conditions and obligations come under by her. A remit was made by the Court to Mr Thomas Scott, factor for Lord Douglas, to report how the fact stood. Mr Scott reported that the tenant had implemented her obligations as to enclosing the land, having in reality already enclosed all that she was bound to enclose during the whole lease; but "that, in respect that the whole of the hedges, which are the only fences upon the farms, are in a very wild and neglected state, the tenant has not fulfilled the obligation she came under 'to keep and preserve the fences when made in good and sufficient repair during the lease;'" and that it would require a sum of L.38, 0s. 9d. to put the fences in proper repair.

The Lord Ordinary (Cuninghame) pronounced the following

Dec. 393,) a proof was allowed of an alleged custom that gardeners are understood to be hired for a year; and Baron Hume, who reports the case, observes that twelve months is the presumed period of engagement of a farm-servant and of a governess in the country. But in the case of *Moffat* v. *Shedden*, *8th Feb.* 1839, (1 *D.* 468,) where a contract with a tutor was, from its terms, held to have been entered into for a year, great doubts were expressed from the Bench, whether, in the case of a tutor or governess, the presumption as to the duration of an engagement was in favour of so long a period as twelve months.

* This statute, commonly called "The Montgomery Act," declares (sect. 1, 2, and 3,) "that it shall and may be lawful to every proprietor of an entailed estate, within that part of Great Britain called Scotland, to grant tacks or leases of all or any part or parts thereof," "for any number of years not exceeding thirty-one years," "provided always that every such lease, for any term of years exceeding nineteen years, shall contain a clause obliging the tenant or tenants to fence and enclose in like manner," (*i.e.* "in a sufficient and lasting manner,") "all the lands so leased during the continuance of such term, and two-third parts thereof before the expiration of two-third parts of such term; and one third-part thereof before the expiration of one-third part of such term; and provided also, that every such lease" "shall contain a clause obliging the tenant or tenants to keep and preserve the fences, when made, in good and sufficient repair during the lease, and to leave them so at the expiration thereof," &c.

interlocutor:—*March* 20, 1846.—"Finds that the lease libelled on was entered into by the defender and the predecessor of the pursuer in 1818, under the authority of the Act of 10 Geo. III. c. 51, and for a term (thirty-one years) exceeding that competent at common law, under an express stipulation and contract, that the tenant 'shall be bound to implement and fulfil the conditions of the Act of Parliament of the 10th year of his (then) present Majesty, for encouraging the improvement of land in Scotland, held under settlement of strict tailzie:' Finds that, according to the legal and necessary construction of this lease, the provisions of the said statute must be held as incorporated in the instrument, and that it was incumbent on the defender, not only to enclose one-third part of the lands let within ten years, and the remaining two-third parts within twenty years, from the commencement of the term; but farther, that the tenant or tenants shall be taken bound 'to keep and preserve the fences, when made, *in good and sufficient repair* during the lease, and to leave them so at the expiry thereof:' Finds it proved, by the report of Mr Scott, that the defender has failed to implement that condition of the statute and lease, by constructing and keeping in repair, the fences, and that it will require L.38, 0s. 9d. to put the fences into repair: Therefore, decerns and ordains the defender forthwith to put the said fences into proper repair, in terms of the report of the said Thomas Scott, or otherwise to make payment to the pursuer of the sum of L.38, 0s. 9d. sterling, with the legal interest thereof from the date of the report till payment, and decerns: Allows decreet to this effect to go out and be extracted *ad interim;* and with the view of still enabling the defender to implement, or the pursuer to give a charge for fulfilment of this interim decree, suspends consideration of the other conclusions of this action for removing and expenses, till the first sederunt-day in May next; and appoints the case, then to be enrolled, for the discussion of the whole points necessary to be determined, in order to exhaust the cause."

The tenant reclaimed against this judgment, and pleaded that she could only be called on to repair such part of the fences as she was bound to have erected up to the present period of her lease; but the Court (First Division) adhered to the Lord Ordinary's interlocutor, "with the qualification that the sum of L.38, 0s. 9d., referred to in the said interlocutor, is to be laid out at the sight of Mr Scott, also therein referred to, in putting the fences in proper repair."*—*M'Neill Hamilton* v. *Hamilton*, 13*th November* 1846.—*Jurist*, xix. 9.

* The summons in this case contained an alternative conclusion; viz. that in consequence of the tenant's failure to implement the conditions of the lease, it

Poor-Law—Power of Inspector to Sue.—A summons was raised, subsequent to the passing of the recent Act 8 and 9 Vict. c. 83, against the Monkland Canal Company, for the recovery of arrears of assessment alleged to be due for several years previous to the date of the Act. The summons was laid at the instance of John Meek, as inspector of the poor for the Barony parish of Glasgow, with the consent and concurrence of certain parties, being a committee of the heritors and kirk-session of the said parish, specially authorised to sue the action. To this summons it was objected that the arrears due to the old Board had not been transferred to the new Board in terms of the 52d section * of the late act; and that the inspector who was appointed under the recent statute, and must be considered as the officer of the new Board, had not power to sue for the arrears under the provisions of the 57th section,† until the property of the old Board had been regularly transferred in accordance with the act. But

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should be found that her lease was thereby forfeited; but at a previous stage, (16*th Dec.* 1845,) the Court (Lord Fullerton dissenting) found "that no irritancy or forfeiture of the lease had been incurred." The Lord Justice-General observed, that there was no "irritancy" of the tenant's right "provided by the Act of Parliament;" but "that, in framing a lease under the authority of this act, it might have been within the power of the landlord to have stipulated such an irritancy—a conventional irritancy—which would have been given effect to in a court of law."—*Jurist*, vol. xviii. 136. 8 *D.* 308.

* The 52d section of the 8 and 9 Vict. c. 83, enacts, "That where any property whatsoever, whether heritable or moveable, or any revenues, shall, at the time of the passing of this act, belong to or be vested in the heritors and kirk-session of any parish, or the magistrates, or magistrates and town-council of any burgh, or commissioners, trustees, or other persons, on behalf of the said heritors and kirk-session or magistrates, or magistrates and town-council, under any Act of Parliament, or under any law or usage, or in virtue of gift, grant, bequest, or otherwise, for the use or benefit of the poor of such parish or burgh, it shall, from and after a time to be fixed by the Board of Supervision, be lawful for the Parochial Board of each such parish, or of the combination in which such parish or burgh may be respectively, to receive and administer such property and revenues, and the right thereto shall be vested in such Parochial Board."

† The 57th section enacts, "That in case it shall be necessary to commence or institute any action by or on behalf of any parish or combination, or Parochial Board for the relief of the poor, such action may be brought in the name of any inspector of the poor of such parish or combination as pursuer; and in any action to be brought against any Parochial Board, it shall not be necessary to call the individual members of the Parochial Board as defenders, but it shall be lawful for the pursuer in such action to call any inspector of the poor of any such parish or combination, and such inspector shall be bound to appear and answer on behalf of the Parochial Board: and all summonses, notices, diligences, decrees, or other proceedings served or obtained, or had against any inspector of the poor, shall be binding on and conclusive against the Parochial Board of the parish or combination for which he is an inspector; and the Parochial Board shall have the entire direction and control of every such action, although the same may be carried on in the name of the inspector."

the Court (First Division) decided that this objection was ill-founded; the Lord Justice-General remarking—"The question is, whether this action, brought by John Meek, inspector of the poor of Barony parish of Glasgow, 'with the consent and concurrence of Andrew M'George,' and others, being 'a committee of the said Barony parish,' is properly before the Court as to the instance of the pursuers. I am clearly of opinion that the instance is quite competent; and that opinion I hold in spite of the objection which has been attempted to be raised on the 52d section of the recent Poor-law Act. For, take it that the Board of Supervision has not transferred to the new Board the property, heritable and moveable, 'vested in the heritors and kirk-session of the parish, or the magistrates,' &c., 'for the behoof of the poor of such parish,' &c., and that therefore that part of the statute has not been followed out; still, if a fair construction is given to the statute, (and such construction we are bound to give it,) there can be no doubt that the action by Mr Meek, for the arrears of assessment due by persons liable to be assessed, is perfectly well founded in the statute. On a proper construction of the 32d section, 'the Parochial Board'—which is there directed to meet 'on the 3d day in September, or on such day thereafter as may be fixed by the Board of Supervision,' for the purpose, *inter alia*, of naming an inspector—is the old Board. Now, on the old Board, as formerly constituted, the duty of naming an inspector is imperative. The Board having accordingly met for that purpose, Mr Meek was named inspector, and installed in his office. What, then, were his duties?—duties imperatively binding upon him, whether the old Board was to continue, or a new Board to be appointed. His duty is set forth in the 57th section of the statute; viz. to sue or defend all actions relative to 'the parish.' He is declared by the statute to be the person who is to sue and be sued. He is at once installed into his office, and it is clear that, unless the interests of the poor are to be abandoned, he must take up his duties at once," &c.—*Meek and Others* v. *The Monkland Canal Company, 14th November* 1846.—*Jurist*, vol. xix. p. 10.

Public Right of Drove-Road and Drove-Stances.—An action was brought by the Marquis of Breadalbane to interdict and prohibit certain proprietors and tenants of lands in the north-western districts of Scotland, interested in the cattle trade, from using certain portions of his property in the county of Argyle as resting-places or drove-stances for cattle, in the transport of these animals from the north to the south. Through the Marquis's property there is a public (Parliamentary) road, which is the line of transit (passing by Glencoe to Callander) from the north-western Highlands to the south of Scotland and to Eng-

land, and the drove-stances in dispute are contiguous to this line of road. There was no servitude of drove-stances in Lord Breadalbane's titles, and the parties interested in the cattle trade had no written grant of servitude over any part of his lordship's land, but they averred that the road in question, with certain deviations, was a public drove-road, and had been such long before it had been converted into a public carriage-road; that drove-stances are necessary accessories to a drove-road, particularly in such a district; and that those situated on Lord Breadalbane's property, in Argyleshire, had been used as a matter of right by them and their predecessors, on payment of certain fixed rates per 100 sheep and score of cattle, for time immemorial. They therefore proposed to prove the alleged use and occupation by themselves and the public of these roads and stances by a jury trial. Lord Breadalbane, on the other hand, contended that this was an ordinary public road, and that no one had right to a servitude of pasturage or of resting cattle on land contiguous to it, any more than in the case of any other public road in the kingdom; that any accommodation which the public may have received in the way of stances for pasturing and resting cattle, was a matter of agreement and not of right; and that the parties in this case were not in a position to demand a proof of prescriptive use, as they had shown no grant or title to which the use of the stances could be ascribed. The Court (First Division) found that there were "relevant averments fit to be the subject of a jury trial," both as to the drove-road and the drove-stances; thereby deciding that a public right to a drove-road, and to drove-stances as accessories of it, may be established by immemorial or prescriptive use alone, notwithstanding that the alleged drove-road had been converted into a public road for carriages; and that the payment of certain fixed rates for the use of the drove-stances may not be inconsistent with the existence of such a right.—*Marquis of Breadalbane* v. *M'Gregor and Others*, *3d Dec.* 1846.—*Jurist*, vol. xix. p. 65.*

Colliery Lease—Lordship computed by the actual Selling Prices at the Hill.—The colliery of New Bogside, in the parish of Kilmaurs, Ayrshire, was let by the proprietors Messrs Robert and James Cochran to Alexander Guthrie, in a formal stamped lease, wherein the rent was declared to be L.200, "or, in the option of the landlords, the selling price of 2-15th parts of the whole coals brought to the pit-head, and sold (after deducting the usual allowance of coals for the colliers and engine, and of all common dross) as lordship, in lieu and full payment of said fixed rent,

* It is understood that the decision in this case is to be made the subject of an appeal to the House of Lords by Lord Breadalbane.

computing the said lordship at the actual selling price at the hill." A dispute having arisen as to the meaning of this clause, the landlords brought an action in the Sheriff-Court of Ayr, against the tenant, for rents due. The tenant, being unsuccessful in the Sheriff-Court, brought the case up by advocation to the Court of Session. The chief point in dispute was, whether the tenant, in estimating the price of coals sold, was entitled to include sales made at a neighbouring harbour, which, being wholesale, and liable to a deduction for carriage, were at a lower rate than those at the pit-mouth, which were chiefly retail. It appeared that, previous to the lease being extended, the tenant had endeavoured to introduce these shipment sales into the computation by an express clause, and that the landlords had rejected this proposition. It was now contended that the clause, as it stood, merely meant the price actually received for the coals, and that it was the invariable practice of the trade to include shipment sales in computing a lordship. The Court (First Division) found, "that in fixing the selling price on which the lordship is to be computed, there must be taken into account the prices got for sales of coals delivered at the pit, whether retail or wholesale; but that the prices got for sales of coal delivered elsewhere than at the pit, are to be excluded."—*Guthrie* v. *Cochrans*, *4th Dec.* 1846.—*Jurist*, vol. xix. p. 69.

ON THE COMPOSITION AND RELATIVE NUTRITIVE VALUES OF THE POTATO, THE YAM, THE SWEET POTATO, MANGOLD-WURTZEL, THE CARROT, THE BEET, THE PARSNIP, AND THE CABBAGE.

By James F. W. Johnston, F.R.SS. L. & E.

As public attention is at the present moment very much directed to the consideration and discussion of the propriety of substituting different root crops in place of the potato, the following summary of the actual state of our knowledge, in regard to the chemical composition and relative nutritive value of these several root crops, will not, I think, be unacceptable to the agricultural public:—

§ 1. *Of the composition of potatoes, and the effect of circumstances in modifying their quality and composition.*

The composition of the potato is, in one respect only, very different from that of our cultivated corn crops. Like all the other root and green crops we cultivate, it is distinguished from grain and pulse by the presence of a large per-centage of water. In other respects it agrees with them. It contains the same kinds

of nutritive matter which are found in the grains. It differs in the relative proportions only in which these substances are found in it.

1°. *Per-centage of water.*—The mean proportion of water contained in the potato is about 75 per cent, or three-fourths of its whole weight. But this proportion varies with the age or state of ripeness of the potato, with the part of the potato examined, with the variety, with the rapidity of growth, with the length of time they have been kept out of the ground, the place in which they are kept, and possibly also with the soil, manure, and climate.

a. Influence of the state of ripeness, &c.—The quantity of dry solid matter contained in the potato, depends very much upon the state of ripeness to which it has attained. The ripest leave 30 to 32 per cent of dry matter, the least ripe only 24 per cent. The mean result of Körte's examination of 55 varieties of potato, gave him for the solid matter 24·9, and for the starch 11·85 per cent.*

The result of 27 analyses made in my laboratory, in 1846, gave for the maximum proportion of water in young potatoes 82, and for the maximum in full grown potatoes 68·6 per cent. The mean of 51 determinations made upon potatoes of all ages was 76 per cent.

b. Water in different parts of the potato.—As a general rule, not without exceptions, however, the proportion of water is greater in the rose or upper end of the potato from which the young shoots spring, than in the heel end by which it is attached to the rootlet. The proportion in the middle of the potato is sometimes intermediate and sometimes greater than at either end. This appears in the following, selected from among many similar results obtained in my laboratory.

	1.	2.	3.	4.	5.	6.	7.	8.
Rose end, .	82·88	79·60	64·41	88·89	80·07	76·56	71·97	82·60
Middle, .	...	...	...	...	73·77	75·30	79·91	85·13
Heel-end, .	80·15	77·83	63·08	88·07	65·33	71·78	74·64	74.80

c. The influence of variety upon the quantity of water in potatoes of the same year, grown in the same field and under the same circumstances, has also appeared from many experiments I have caused to be made. Thus while the cup potato gave 74, the variety called buffs gave 77 per cent. But it is impossible always to determine how much is really due to variety, and how much to the period of growth or other causes.

2°. *Proportion of starch.*—A large proportion of the solid matter of the potato consists of starch. When the potato is grated upon a fine grater under a stream of water, the starch passes

* Schübler, *Agricultur Chemie*, ii. p. 213.

through in the form of a fine white powder, and the fibre or cellular matter remains behind.

The average proportion of starch in the potatoes of this country, according to numerous experiments made in my laboratory during the year 1846, is,

In the natural state, . .	15·72 per cent.
In the dry state, (free from water,)	64·20 per cent.

But this proportion varies with many circumstances. Thus,

a. The heel end usually contains most starch, and the centre least. In three varieties we obtained of starch per cent.

	Belfast rounds.	Red potato.	Kidneys.
Rose end. . .	19·15	16·42	14·84
Centre, . .	14·40	13·73	13·87
Heel end, . .	18·70	20·93	17·48

b. The variety also affects the proportion of starch. Thus I obtained the following among many other results from potatoes grown in Scotland in 1846:

	Per cent.
Red potato, (Lanarkshire,) . . .	14·08 of starch.
Small Americans, ...	17·80 ......
Orkney potatoes, ...	17·42 ......
Buffs, (Forfarshire,)	20·71 ......
Kidneys, ...	14·93 ......
Cups, (Argyleshire,) . . .	15·14 ......

Different varieties grown on the same soil also differ in their yield of starch.

Thus the following varieties of potato grown by Mr Fleming at Barrochan, in Renfrewshire, in 1842, yielded respectively of starch—

	Per cent.
Connaught cups, ...	21
Irish blacks.	16½
White dons, ...	13
Red dons, ...	10¾

—while, according to a starch manufacturer in that neighbourhood, 11½ per cent had been the average quantity obtained from the common *rough red* of good quality during the previous four years.

The difference in the quantity of starch yielded by the above-named varieties is the more striking when it is taken in connexion with the weight of each per acre, raised from the same land treated in the same way. These weights were as follows:—

	Manure.	Produce per acre.	Containing of starch.
Cups,	with 4 cwt of guano	13¼ tons	2·9 tons.
Red dons,	with 4 cwt. of guano	14¼ tons	1·5 tons.
White dons,	with 3 cwt. of guano	18½ tons	2·4 tons.

So that of these three crops, that of *cups*, which weighed the

least, gave the largest produce of starch. They yielded nearly twice as much as the *red dons*, which were half a ton heavier, and one-fifth more than the *white dons*, the crop of which was greater by five tons an acre. Such differences as these, in the relative quantities of starch, which may be obtained from an acre of the same land by the growth of different varieties of potato, are deserving of the attentive consideration of the practical man.

c. The soil, locality, or mode of treatment also affect the proportion of starch in the potato. Thus the same variety of potato grown in different localities gave me

	Mid-Lothian.	Forfarshire.	
Buffs, .	14·89	20·71	
	Argyleshire.	Mid-Lothian. 1.	Mid-Lothian. 2.
Cups, .	15·14	23·82	18·94

d. The effect of keeping upon potatoes is to diminish the proportion of starch. Their weight diminishes from 4 to 7 per cent, and the proportion of starch lessens at the same time. Thus Payen found the same variety of potato to yield in

	Per cent.		Per cent.
October, .	17·2	February, .	15·2
November, .	16·8	March, .	15·0
December, .	15·6	April, . .	14·5
January .	15·5		

This diminution is probably owing to the conversion of a portion of the starch into sugar and gum.

When potatoes are rendered unfit for food by being frozen and suddenly thawed, the quantity of starch which they are capable of yielding when immediately grated has undergone no diminution.

3°. *The proportion of fibre* is very variable, but in the ordinary state of the potato it averages about 3, and in the dry state about 13 per cent of the whole weight. It varies, however, very much —in some being as little as 1½, in others as much as 10 per cent, even in their natural state of dryness. I give the following as some of the extreme determinations of the fibre in the natural and in the dried state, obtained from Scotch potatoes grown in 1846. I have included also the proportion of starch:—

	Fibre.		Starch.	
	In natural state.	In dry state.	In natural state.	In dry state.
Cups,—Mid-Lothian,	1·75	10·91	18·94	75·14
Buffs, do.	4·45	17·70	14·89	59·16
Whites, do.	5·69	19·51	16·73	57·31
Orkney potatoes,	8·41	24·10	17·42	49·91
White,—Argyle,	10·60	32·12	18·07	60·82

From these results it appears that the proportion of fibre varies very much, though in most cases a portion of starch, and always a small quantity of coagulated albumen, adheres to the fibre and adds to its apparent weight. It is to the presence of this starch and albumen that the nutritive properties of the potato fibre—the pulp of the potato mills—is partly owing, though the tender fibre (cellulose) is capable of being partially dissolved or digested in the stomachs of the animals that are fed upon it.

4°. *Proportion of fat.*—When the potato is sliced, dried, and digested in ether, a portion of fat is extracted from it, which is usually smaller, however, than from any of our grain crops. It varies from 0·15 to 0·52 per cent in the potato in its ordinary state, but it averages about 0·24 in the one, and 1·0 per cent in the other.

5°. *Proportions of gum and sugar.*—In the watery solution which floats above the starch—when a potato has been grated in a stream of water, and the water allowed to settle—there is always contained a small quantity of sugar, and of that species of gum which is formed by the action of sulphuric and other acids upon starch, and to which the name of dextrin is given. The maximum, minimum, and average of these substances in the healthy potato is nearly as follows, as deduced from numerous analyses made in my laboratory—

	Maximum.		Minimum,		Mean.	
	Sugar.	Gum.	Sugar.	Gum.	Sugar.	Gum.
In natural state, .	5·1	0·94	1·1	0·07	3·3	0·55
In dry state, .	23·2	3·0	5·5	0·35	13·47	2·25

In diseased potatoes the sugar is sometimes upwards of 7, and the gum of 2 per cent in the natural state of the potato. This, however, is the result of a change of the starch into these substances as a result of the progress of disease. In all cases when these two substances are unusually large, the starch is small in like proportion.

6°. *Proportion of protein compounds.*—When the water with which the grated potato has been washed is filtered and then boiled, a small quantity of albumen coagulates and falls in flocks: If after this is separated, and the liquid allowed to cool a little, acetic acid (vinegar) is added to it, a white powder falls, which, like that obtained in the same way from oatmeal, peas-meal, or from wheat or barley flour, has much resemblance to the curd of milk, and therefore for the present, and till it has been carefully analysed, is called casein. Further, if the dry potato in powder be boiled in alcohol, the solution evaporated, and water added to it, a white glutinous substance is separated, resembling the gluten of wheat. Lastly, if the dry fibre or pulp be boiled in acetic acid, and carbonate of ammonia afterwards added to the clear solution, a portion of white matter falls, which is believed to be

albumen existing in or attached to the fibre in a coagulated state.

Thus the potato contains all the different protein compounds usually found in the cultivated grains, though in its natural watery state they are present in it in small and variable proportions only. Thus in the natural state of the potato, according to experiments made in my laboratory,

	Per cent.
The gluten varies from	0·11 to 0·56
The albumen	0·03 to 0·75
The casein	0·02 to 2·44

But the average sum of these three constituents extracted in the way I have described, is about 1·4 per cent of the weight of it in its natural state, or 5·8 per cent when freed from water.

But by the method of extraction above described, the whole of the protein compounds is not obtained, and therefore their true proportion in the potato is incorrectly estimated. By determining the nitrogen, and from its amount calculating the protein compounds, a higher number is obtained for their proportion in the dry potato. Thus Horsford obtained for the per-centage of these compounds in the dry matter of potatoes grown at Giessen,

In white potatoes, ...	9·96 per cent.
In blue, ...	7·66

And my assistant, Mr Fromberg, obtained from 7·3 to 14 per cent in different portions, samples, and varieties of potatoes. He found also that not only is the proportion different in different varieties, but that it is greater also in young potatoes than in old, and often also in the one end or in the centre of the potato than in the other end.

According to Boussingault, the proportion of these protein compounds diminishes the longer the potato is kept. Thus in newly dug potatoes he found them to amount to 2¼, but in long kept potatoes to only 1½ per cent of their weight. These are equivalent to 9 per cent and 6 per cent respectively in the dry potatoes at the two periods.

In potatoes attacked with the prevailing disease, the proportion of protein compounds diminishes. They are partially decomposed, producing ammonia and other compounds.

The proportion of protein compounds, chiefly coagulated albumen, in the potato *fibre* is also greater than we should suppose—being found by Fromberg to vary from 3·2 to 6·3 per cent of the weight of the fibre in the dry state, the mean being between 3½ and 4 per cent. This must contribute, as I have already said, to the nourishing properties of the refuse of our potato-mills.

7°. *Proportion of saline matter.*—The potato when dried and burned leaves a quantity of ash, which varies from 0·76 to 1·58 of the weight of the potato in its natural state, or from 2·3 to 4·7

per cent of the weight of the potato in its dry state. This ash consists in large proportion of potash and soda salts.

It is a curious circumstance in reference to the inorganic matter of the potato, that a considerable proportion of the lime it contains exists in the state of crystallized oxalate of lime. These crystals are in many cases readily seen by the microscope, but what functions they perform—whether they are a natural and necessary, or a diseased product—it is impossible as yet, with any degree of confidence, to pronounce. When the potato is burned this oxalate is decomposed, and the lime is found in the ash in the state of carbonate—unless it combine during the heating with some of the phosphoric or other fixed acids contained in the potato.

8°. *Average composition of the potato.*—The several ingredients of the potato vary, as I have stated above. Its average composition is nearly as follows:—

a. Taking the mean of the results of Einhoff, Lampadius, and Henry.

	In natural state.	In dry state.
Water,	75·28	...
Starch,	14·25	58·12
Dextrin (gum,) and sugar,	2·08	8·24
Protein compounds,	1·10	4·50
Fibre,	7·12	29·14
	99·7	100

b. Taking the mean of the numerous analyses of healthy potatoes made in my laboratory in 1846.

	Natural.	Dry.
Water,	75·52	...
Starch,	15·72	64·20
Dextrin (gum,)	0·55	2·25
Sugar,	3·30	13·47
Albumen, casein, glutin, &c.,	1·41	5·77
Fat,	0·24	1.00
Fibre, with a little starch adhering,	3·26	13·31
	100	100

When the above substances are separated from each other in the way I have described, a portion of the albumen and glutin still adheres to the fibre, and of both with some of the so-called casein, to the starch, so that the true per-centage of protein compounds is something higher than in the above table.

In round numbers, indeed, the average composition of the dry potato may be represented pretty nearly as follows:—

Starch,	64
Sugar and gum,	15
Protein compounds,	9
Fat,	1
Fibre,	11
	100

The dry potato, therefore, in nutritive value is not far behind the average of our finer varieties of wheaten flour, and is about equal to that of rice.

This appears in the following comparative view of the composition of dry rice and the dry potato.

	Dry Potato.	Dry Rice.
Starch, Sugar and gum,	79	87·4
Protein compounds,	9	7·5
Fat,	1	0·8
Fibre or husk,	11	3·4
Saline matter (ash,)	...	0·9
	100	100

The principle difference here is in the proportions of fibre or husk. But the fibre of the potato, as I have already said, retains a portion of starch and other nutritive matter, and therefore, the real quantity of indigestible fibrous or woody matter in the potato, is by no means so great as the per-centage of fibre appears to represent it.

§ 2. *Influence of soils and manures upon the quantity and quality of the potato crop.*

The potato thrives best on a light loamy soil—neither too dry, nor too moist. The most agreeably flavoured table potatoes are almost always produced from newly broken up pasture ground, not manured, or from any new soil.* When the soil is suitable, they delight in much rain, and hence the large crops of potatoes obtained in Ireland, in Lancashire, and in the west of Scotland. No skill will enable the farmer to produce crops of equal weight on the east coast, where rains are less abundant. *It has not been shown, however, that the weight of starch produced in the less rainy districts is defective in an equal degree.* Warm climates and dry seasons, as well as dry soils, appear to increase the per-centage of starch.

Potatoes are considered by the farmer to be an exhausting crop, and they require a plentiful supply of manure. By abundantly manuring, however, the land in the neighbourhood of some of our large towns, where this crop is valuable, has been made to produce potatoes and corn every other year, for a very long period.

11°. *Saline mixtures* exercise a remarkable influence in promoting the growth and increasing the quantity of the potato crop in some localities. The most striking effects of this kind hitherto

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* Loudon's *Encyclopædia of Agriculture*, p. 847.

observed in our island have been produced by mixtures of the nitrate of soda with the sulphate of soda, or with the sulphate of magnesia.* The effect of such mixtures affords a beautiful illustration of the principle I have frequently before had occasion to press upon public attention—that plants require for their healthy growth a constant supply of a considerable number of different organic and inorganic substances. Thus upon a field of potatoes, the whole of which was manured alike with 40 cart-loads of dung, the addition of

a. Nitrate of soda alone gave an increase above dung alone of	3¼ tons.
Sulphate of soda alone gave no increase.	
While one-half of each gave . .	5¼ ...
b. Sulphate of ammonia alone gave .	1¾ tons.
Sulphate of soda, no increase.	
But one-half of each gave . .	6⅛ ...
c. Nitrate of soda alone gave an increase of	3¼ tons.
Sulphate of magnesia alone gave . .	½ ...
And one-half of each gave . .	9¾ ..

Such results are very interesting, and if followed up by an examination of the *quality and composition* of the several samples of potatoes produced—cannot fail to lead to very important practical and theoretical conclusions.

2°. *Failure of seed potatoes.*—The seeds of all cultivated plants are known at times to fail, and the necessity of an occasional change of seed is recognised in almost every district. In the Lowlands of Scotland potatoes brought from the Highlands are generally preferred for seed, and on the banks of the Tyne, Scottish potatoes bring a higher price for seed than those of native growth. This superior quality is supposed by some to arise from the less perfect ripening of the *up*-land potatoes, and by others to some peculiar effect or quality of new land, on which skilful farmers, who do not import or buy, raise the potatoes they intend for the next year's seed.

These may in part be true explanations of the fact. The better quality of unripe seed may arise from its containing a larger per-centage of nitrogenous (protein) compounds, if, as many believe, *whatever increases the per-centage of starch, increases also the risk of failure in potatoes that are to be used for seed.* The subject is deserving of further investigation.

It may be doubted, however, whether the relative proportions

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* See the Author's *Suggestions for Experiments in Practical Agriculture.*

of starch are to be considered as the *cause* of the relative values of different samples of seed potatoes. This proportion may prove a valuable test of the probable success of two samples when planted, without being itself the reason of the greater or less amount of failure. With the increase of the starch, the albumen and the saline matter of the potato may in some degree diminish, and a certain minimum proportion of *both of these* is necessary to its fruitfulness when used for seed.

The value of the saline matter is beautifully illustrated by the observation of Mr Fleming, that the potatoes top-dressed with sulphate and nitrate of soda in 1841, and used for seed in 1842, "presented a remarkable contrast to the same variety of potato, planted alongside of them, but which had not been so top-dressed in the previous season. These last came away weak, and of a yellowish colour, and under the same treatment in every respect did not produce so good a crop by fifteen bolls (3¾ tons) an acre." This observation, made in 1842, was confirmed by the appearance of the crops of 1843, upon Mr Fleming's experimental fields. In later years, however, even his doctored seed has not escaped the destructive ravages of the disease of 1845 and 46.

It has been said, in some parts of Scotland, that the disease was prevented by the use of saline mixtures in 1845, but the same mixtures failed of their effect in the hands of the same parties in 1846. In Norway, common salt is supposed to have saved the potato from disease. At the present moment sulphate of magnesia is lauded as a specific against the disease, because of some supposed good effects produced by it near Whitby in 1846. I fear, however, that should the disease be equally virulent and extensive in 1847, that this salt will lose its character like all the others.

§ 3. *Composition of the Yam and the Sweet Potato.*

The destruction of the potato crop in Europe having turned public attention very much to the nature and value of the productions of other countries, it has been thought by some that the yam and the sweet potato may possibly form useful articles for importation.

Of both roots or tubers, I believe there are several cultivated varieties. Two varieties of the former—the water and the Guinea yam—and one of the latter, were imported from Barbadoes during the last summer, (1846,) and put into my hands for examination by my friend Mr Milne. They were analysed in my laboratory, and were found to consist respectively of—

	Water yam.	Guinea yam.	Sweet potato.
Water, ...	64·80	75·53	59·31
Starch, ...	24·10	17·45	16·62
Dextrin, ...	0·36	0·21	0·55
Impure sugar, ...	3·92	3·47	7·99
Albumen, ...	0·25	0·70	trace.
Casein, (so-called,) impure, .	2·69	1·74	2·66
Fibre, with a little oil and coagulated albumen, . . .	3·76	1·61	12·88
	99·88	100·71	99·41

In these analyses, and from these specimens, it appears—

a. That the Guinea yam has much resemblance in composition to the potato—the proportion of water being the same, and that of starch being only a little more than in the potato.

b. That the water yam contains 11 per cent less water than the potato, and 8 or 9 per cent more starch.

c. That the sweet potato contains less water and about the same proportion of starch as the potato, with 5 per cent more sugar—to which its sweetnees is owing—and nearly 10 per cent more fibre.

d. That of protein compounds, (albumen, &c.,) capable of being separated and collected, these three samples all yielded a larger per-centage than the potato.

When burned, however, for the determination of the nitrogen and the protein compounds calculated from the latter, they do not appear to exist in either the yams or the sweet potato in so large a proportion as in the average of our cultivated potatoes. At least my assistant Mr Fromberg found by this method the proportion of protein compounds to be—

	Natural State.	Dried at 212 degrees.
Water yam, . .	2.08	5.92
Guinea yam, . .	1.49	6.16
Sweet potato, . .	2.27	5.50

These numbers are less than those which represent the weight of albumen and of so-called casein actually extracted; and though these latter substances were necessarily impure, yet the subject is obviously open to further investigation.

§ 4. *Composition of the Turnip.*

The potato, among cultivated roots, is characterised by the large proportion of starch it contains. The turnip, carrot, beet, mangold-wurtzel, and parsnip, differ from it in containing much more sugar, with little or no starch, but in its stead a large pro-

portion of a substance to which the names of pectose and pectic acid are given. The nature and properties of these substances it would be out of place here to describe.

The turnip is a root which, to the skilful cultivator, yields a very large return of nutritive matter. Crops of thirty tons of bulbs per imperial acre are not unfrequently grown, but very much greater returns are occasionally published.

Thus in 1814, the Duke of Portland's farm, in the parish of Dundonald, yielded, of a variety not mentioned,—

	Scotch acre.	Imperial acre.
Without leaves, . .	76 tons. .	61 tons.
With leaves, . .	90	72 ...

And in the parish of Irvine, in the same county, Mr Taylor of Stonearth grew, of white turnips, $68\frac{1}{3}$ tons per Scotch, or 55 tons per imperial acre.

The first of these crops is equal to 6 tons, the latter to $5\frac{1}{2}$ tons of dry nutritive matter per imperial acre.

These roots contain a very large per-centage of water, a circumstance which renders them less fit for human food; and, because of the cost of transport, makes it necessary in most cases to consume them near the spot where they are grown.

Many varieties of turnip are cultivated, but they have not been subjected to a rigorous chemical analysis—an object of much importance to practical husbandry. The following table represents the composition of certain varieties of Scotch turnips, which have been examined in my laboratory:—

	Grown on different soils.			On same soil.		On same soil.	
	No. 1.	No. 2.	No. 3.	Purple. No. 4.	Yellow. No. 5.	Purple. No. 6.	Yellow. No. 7.
Water, ...	89.30	89·42	89·00	88·46	88·60	87·45	88·31
Sugar, ...	5·61	6·21	6·54	6·90	6·92	8 39 (Sugar and Gum)	7·67 (Sugar and Gum)
Gum, ...	0·11	0·11	0·16	0·09	0·09		
Albumen, ...	0·72	0·47	0·36	0·19	0·22	0·32	0·21
Pectic and Meta-pectic Acids, ...	1·76	1·33	1·51	...	...	3·84 (Pectic Acids, Oil and Cellular Fibre)	3·81 (Pectic Acids, Oil and Cellular Fibre)
Oil, ...	0·19	0·22	0·18	0·26	0·30		
Cellular Fibre, ...	1·63	1·75	1·59	3·39	3·00		
Saline matter, ...	0·54	0·49	0·59	0·68	0·62		...
	99·86	100·	99.93	99 97	99·75	100·	100·

The first three of these analyses represent the composition of the same variety of turnip grown on different soils by Mr Mylne, farmer, near Tranent, the next two were grown on the same soil by the late Mr Aitchison of Drummore, near Musselburgh, and

the two last were grown on the same soil, near Haddington, by Mr Roughead. Most of the analyses were made for practical purposes, and therefore all the ingredients were not in every case determined separately, as the table shows.

The proportion of sugar contained in these roots is greatest when they are young, and diminishes as they ripen. In the beet it has been observed that the nitrates of potash and ammonia are present in considerable quantity, and that in the old beet these nitrates become more abundant as the sugar diminishes. In the beet also, when raised by the aid of rich manure, the production of nitrates is increased more than that of sugar. According to Payen, the beet, when raised with street manure, contains 20 times as much *saltpetre* as when raised in the ordinary manner. The same may possibly be the case with the common cultivated turnips.

The proportion of albumen and other protein compounds is not truly represented in the analyses above given. When the turnip is grated in water, and the clear liquid boiled, as in the case of the potato, a portion of albumen coagulates and falls, and on separating this, and adding a little acetic acid, a small proportion of a substance, resembling casein, is thrown down. Alcohol extracts from the fibre a portion of glutin, (?) so that the turnip contains all the same principal varieties of the protein compounds which are present in our other cultivated crops. By this method of separating them, however, it is impossible to obtain exact results, and the quantity obtained is generally less than the truth. By the method of combustion, however, which gives the proportion of nitrogen, and of thence calculating the protein compounds, a more accurate determination is in general obtained. Thus, three varieties of turnips, grown in Germany, gave Mr Horsford by this method the following proportions of protein compounds, in their natural and in their dried state, respectively.

	In natural state.	Dried at 212 deg.
Yellow turnip, . .	1·54	9·25
Red turnip, . . .	2·83	15·50
Kohl Rabi . . .	1·54	12·64

According to these results, the dry matter of the yellow turnip contains a little more of the protein compounds than the average of our cultivated potatoes, while that of the red turnip and the Kohl Rabi are as rich in these ingredients as the average of our barley, wheat, or oat crops. It would be interesting to test these results by a greater number of such analyses.

§ 5 *Composition of Mangold-Wurtzel, and of the Beet, Carrot, Parsnip, and Cabbage.*

1°. *Mangold-Wurtzel.*—Very large crops of this valuable root

are obtained from some soils. The crop from which the specimens were taken, for the subjoined analyses, was grown by Colonel Kinloch of Logie, in Forfarshire, upon land forked $2\frac{1}{2}$ feet deep, and was "considered to be fully 40 tons an acre," (Scotch.) This root is a very valuable food for cattle, is much relished by them, fattens well, and gives a rich milk. The orange-globe is preferred to the other varieties usually cultivated. Three of these examined in my laboratory by my assistant, Mr Cameron, yielded, per cent,—

	Long red.	Short red.	Orange globe.
Water	85·18	84·68	86·52
Gum, ...	0 67	0 50	0·13
Sugar, ...	9·79	11·96	10·24
Casein, (so called,) . .	0·39	0·26	0·33
Albumen, ...	0 09	0·18	0·03
Fibre and Pectic acid, .	3·08	3·31	2·45
	99·20	100·89	99·70

It appears from the above results that they contain less water, and therefore more solid nutritive matter than the turnip.

Few accurate determinations have yet been made of the percentage of protein compounds in this root. The sum of the albumen and casein above given represents them as forming only 0·5 or $\frac{1}{2}$ per cent of their weight when fresh. This is, no doubt, too little—an error which, as in the case of the turnip, necessarily attends the method of analyses adopted.

In the dry mangold-wurtzel, of the three varieties above mentioned, my assistant, Mr Fromberg, obtained, by the method of combustion, the following proportions of the protein compound in the natural state, and when dried at 212° F. respectively:—

	Orange globe.	Short red.	Long red.
Nitrogen, - - -	2·29	2·21	1·72
Protein compounds (in dry state,)	14·40	13·88	10 79
... ... (in natural state,)	1·94	2·12	1·60

It is probable that the so-called red turnip examined by Horsford, and said by him to contain only 81·6 of water and 2·83 of protein compounds, or 15·50 per cent, when dried at 212°, was in reality a variety of mangold-wurtzel. If so, this root must be considered as very rich in these compounds.

It is a practical objection to this crop, which does not apply to the Swede turnip, that it is unable to stand the frost, and must therefore be taken up and stored when severe weather is expected. It is said also to produce paralysis in the cattle which are fed with it. I should not, however, think this likely to be a frequent occurrence.

2°. *The Carrot, the Beet, and the Parsnip.*—These roots have

been examined respectively by Hermbstädt, Payen, and Crome, with the following results:—

	Common Carrot, (Hermbstädt.)	Sugar Beet, (Payen.)	Parsnip, (Crome.)
Water,	80·0	85·0	79·4
Starch and Fibre,	9·0	3·0	6·9
Gum,	1·75	2·0	6·1
Sugar,	7·8	10·0	5·5
Oil,	0·35	—	
Albumen,	1·1	?	2·1
	100.	100·	100·

The above analyses are very imperfect, and require to be repeated. Horsford determined the proportions of water and protein compounds in a carrot and a red beet, grown at Giessen. The following were his results per cent:—

	Water.	Protein compounds in natural state.	Protein compounds dried at 212 deg.
Carrot,	86·10	1·48	10·66
Red Beet,	82·25	2·04	11·56

The dry matter in these roots is by these experiments richer than that of the potato in compounds containing nitrogen.

3°. *The Cabbage.*—I regret to say that our present knowledge of this valuable esculent is almost nothing. In my laboratory, the proportion of water in the leaves of several varieties of cabbage has been found to average 92 per cent, and in the stalk 84 per cent. The dry solid matter of the leaf contains from 7 to 20 per cent of inorganic or mineral matter, in which there is much sulphuric and phosphoric acids.

The dry matter of the cabbage is unquestionably very nutritive, though the proportion of protein or supposed muscle forming constituents, has not as yet been determined.

The flower of the cabbage, however, (cauliflower,) in the dry state, has been found to contain as much as 64 per cent of those compounds, gluten, albumen, &c., or more than any other known vegetable substance. The common mushroom in the dry state is the only vegetable, as yet known, which approaches to this proportion.

Were it possible to dry cabbage, therefore, it would form a very concentrated food.

§ 6. *Relative nutritive properties of the Potato, Turnip, Carrot, Mangold-Wurtzel, and Cabbage.*

The large proportion of water in the turnip, carrot, and mangold-wurtzel is a point of much importance in reference to their nutritive and economic value. This proportion varies in different samples and varieties,—though the extent of this variation

has not yet been ascertained by a sufficiently numerous set of experiments. The following table exhibits the different results hitherto published. Those marked J. were obtained in my laboratory.

	Einhof.	Playfair.	Hermbstädt.	Horsford.	J.
White turnip, ...	92	87	79	...	...
Yellow (Swedish,)	87½	85	80	83	88, 88½
Purple top do........	...	...	...	...	87½, 88½
Kohl Rabi, ...	86	...	78	88	...
Red turnip, ...	...	...	...	81½	...
Mangold-wurtzel, ..	...	...	...	...	84½, 85, 86½
Cabbage, ...	...	...	...	...	92
			Payen.		...
Sugar beet, ...	...	...	85	...	...
Red beet, ...	...	...	...	82	...
			Hermbstädt.		
Red carrot, ...	86	...	80	86	87, 80
White do............	...	87	...	...	80

The differences among these results, or their important relation to the economic value of the several roots, will become more striking if, instead of the water, we consider the proportions of dry solid matter which they severally contain, according to the different experimenters. These appear in the following table, which exhibits the per-centage of dry matter in the different roots named.

	Varieties of Turnip.					Mangold-Wurtzel.			Beet.		Carrot.	
	White.	Yel-low.	Purple top.	Kohl rabi.	Red.	Long red.	Short red.	Orange globe.	Red.	Sug.	Red.	White.
Einhof, ...	8	12½	...	14	...	...	...	...	...	...	14	...
Playfair, ...	13	15	...	...	...	...	...	...	...	...	...	13
Hermbstädt	21	20	...	22	...	...	...	...	...	...	20	...
Horsford, ...	...	17	...	12	18½	...	...	...	18	...	14	...
Johnston, ...	...	11½	11½	...	...	15½	15	14½	young.		13	
		12	12½								20	20
Payen, ...	...	...	...	...	...	...	...	...	...	15	...	...

In reference to the nutritive value of these roots, the above table presents to us three considerations.

1°. That in the same kind of root and even in the same variety the proportion of solid nutritive matter varies very much. Thus the white turnip, according to three authorities, contains 8, 13, and 21 per cent of nutritive matter—while in the yellow turnip the solid matter varies from 11½ to 20, in the kohl rabi from 12 to 22, and in the red carrot from 14 to 20.

My own experience, however, and it is supported by all the other results, inclines me to reject the numbers of Hermbstädt as generally too high. They would, I fear, form a very unsafe basis for any reasoning as to the economic value of most of the root crops of the above kinds which are raised in this country.

Rejecting these, therefore, we have the solid matter in the yellow turnip varying from 11½ to 17 per cent, or from 2 to 3—some crops containing one-half more nutritive matter, that is, in the same weight than other crops. In other words, 20 tons of one crop may be as feeding as 30 tons of another. This is a very important fact in reference to the actual value in feeding cattle of any given crop of yellow turnips, and has probably much to do with the very discordant results, obtained by different farmers from the use of this kind of food in feeding or fattening their stock.

In the turnips of this winter (1846 and 1847) some peculiarity has, in certain districts, appeared. They do not feed so well as usual, and, by practical men, are said to be *watery*, though, whether they really contain more water than usual or not, no one has as yet thought of examining.

2°. Taking the mean of the other proportions of water in the white and yellow turnips, the mangold-wurtzel, and the carrot, we have for the relative amount of solid food in these four roots the following numbers—

Turnips.			
White.	Yellow.	Mangold-Wurtzel.	Carrot.
10½	13½	15	14

so that the yellow turnip and the carrot, in so far as these numbers are to be depended upon, are worth one-third more than the white turnip—while the mangold-wurtzel is nearly one-half more nutritive than the white turnip, and about a ninth part more so than the yellow turnip.

3°. But if we compare these numbers with the average proportion of solid matter contained in the potato—25 per cent—we see that even the mangold-wurtzel contains only three-fifths of the solid nourishment present in the potato, while it of course conveys into the stomach a proportionably large quantity of water. Another point, however, is to be borne in mind in comparing those two roots—that the protein compounds exist in the solid matter of the mangold as well as in that of the yellow turnip in larger average proportion than in that of the potato. Thus they contain respectively, when dried at 212° F.—

	Protein Compounds.	Other nutritive matter.
The dried potato, ...	8 per cent.	82
... yellow turnip, . .	9½ ...	80
... mangold-wurtzel, .	15½ ...	75

or the protein compounds in the mangold-wurtzel are nearly double of what they are in the potato. This is a very important fact, and is deserving of further investigation. If, as at present supposed, the protein compounds serve the purpose when eaten, of supplying the materials of their muscle to animals, the mangold-wurtzel ought to be considerably superior in this respect to the potato. Even in their natural state this should be the case, since 100 pounds of the mangold-wurtzel contain of these protein compounds, according to the above determination, 2¼, while the potato contains on an average only 2 pounds.

It is to be desired, therefore, that the mangold-wurtzel should be more generally cultivated wherever circumstances are favourable to its growth.

In reference to the subject of the preceding paper, I think it proper to add two observations.

1°. Though I have been able to introduce many new facts—the result of researches made in my own laboratory—yet the intelligent reader cannot fail to have been struck with the imperfect state of our knowledge in regard to these vegetable substances. And yet, upon these green crops, the present condition of our improved or alternating husbandry almost entirely depends. Upon a knowledge of their composition, the most economical and profitable use of these crops in the feeding of stock can alone be securely based. Why, then, should so important a branch of rural economy be permitted to rest on so insecure a foundation? Why should we remain so long in ignorance of the true nature of the relative nutritive property of crops so very important? Their composition is a matter of national concern. Government might be supposed likely to interest itself in procuring the solution of our doubts. But have our national agricultural societies no fund to devote to subjects so important? or, where funds abound, is knowledge wanting? It is to be regretted that the income of the Agricultural Chemistry Association is not sufficient to enable it alone to solve all these important chemical questions, within any reasonable period of time.

2°. It must have also struck the reader, that, among all the crops above mentioned, there is none which can be recommended as a useful substitute for the potato. The mangold-wurtzel comes nearest to it; but still, while 100lbs. of potatoes contain 25lbs. of dry nutritive matter, the same weight of mangold-wurtzel contains only 15lbs. The potato is inferior to rice, in containing 72 per cent more water. Mangold-wurtzel is inferior to the potato, in containing ten per cent more water still.

It is this large proportion of water which, as a main reason, re all these root crops inferior to grain—it is for the same r chiefly, that the turnip and mangold-wurtzel are inferior potato.

There is, however, another reason also why the potato c be replaced by these other roots. In the healthy ripe p the principal ingredient is starch. The properties of this are such as to allow the potato to be boiled, and in other cooked, without sensible loss. Not so the turnip, the carr the mangold-wurtzel. They contain much sugar, and of considerable proportion is removed by boiling in water, destroyed by roasting, and similar methods of preparing f table.

I have also said, that these roots, instead of starch, con large proportion of a jelly-forming substance, to which the of pectic acid has been given. It has not yet been ascertair what degree this pectic acid can replace the starch of the p and of our cultivated grains, as a nourishing food for man.

Used alone, however, I think we may fairly conclude th turnip, carrot, cabbage, &c., can never take the place o potato as food for man; as, in the feeding of cattle, som food must be given along with them, if they are to become he articles of nourishment.

Bread made from wheaten flour, with a certain admixtu turnips or mangold-wurtzel, has, therefore, been recomm above as nutritive and economical. To such mixtures there c no theoretical objection, provided the taste of the people to them, and they prove to be really economical. I fear, ever, that the final result must be, should the potato contin fail, that a diet of grain, almost alône, must succeed to a d potatoes.

EXPERIMENTS RELATING TO THE THEORY OF MANUR

By M. F. Kuhlmann.

Translated from the *Annales de Chimie et de Physique*. Troisième Sé tome xviii. p. 138.*

In a former paper that I had the honour to lay before the demy in November 1843, my object was to demonstrate the ef of employing, for the fertilization of the soil, salts which cont

* Professor Johnston, thinking that this paper might be interesting to cal farmers, requested me to translate it.—David F. Jones.

nitrogen either in their acid or in their base, and to contest some contrary assertions that had been stated. I had perceived, from a long experience in the use of these salts, that the question of their influence on vegetation was not one of science alone, but that the successive diminution in the commercial value of these products, had rendered it one of practical economy, which will become daily of more importance.

I have established, by the most evident facts, that saline nitrogenous substances stimulate vegetation with a degree of energy which is in proportion to the nitrogen they contain; that they share this property with all nitrogenous substances of the organic kingdom; and that these essentially beneficial aliments dispose the plants to a quicker assimilation of all the other constituent principles: in short, I have endeavoured to establish how ammoniacal salts can act as a means of transport, in plants, for certain substances, insoluble or sparingly soluble in water, and also in what manner their influence exerts itself to change the chlorides of potassium and sodium into salts, with organic acids, capable, on burning, of giving carbonates of potash and soda.

The results of my experiments of 1843, could leave no doubt as to the value of the conclusions that I thought deduceable from them; nevertheless, as the object was, in this case, to establish the practical application of agents, the use of which in agriculture is still under trial, I thought I ought to repeat, in 1844, a part of these same experiments, to which I added a great number of others, in order to be able to answer the following questions, relating to different points in the theory of manures, the solution of which appeared to me to be of vast importance to agricultural industry.

1°. Does the quantity of nitrogen of a manure, independent of the mineral substances, always determine the degree of activity this manure ought to exercise upon vegetation? What are the circumstances in which the influence of a manure is not proportional to the quantity of nitrogen it contains?

2°. Do nitrates used as manures owe a portion of their action to their base, or must we consider their action as determined, if not exclusively, at least, for the greater part, by the nitrogen of their nitric acid?

3°. The intervention of phosphates in vegetation cannot be disputed, since these salts always exist, and often in large quantities, in the ashes of plants. Must we infer from this that these salts, taken by themselves, are to be considered as active agents in fertilizing the soil, or is their influence subordinate to the existence of the nitrogenous products?

4°. In organic manures there usually exist non-nitrogenous substances. Do these substances act an important part to

wards fertilization; or, in other words, do there exist manures, composed of non-nitrogenous organic substances, which are susceptible of some energy of action? For instance, does the oil of the oil-cake give this manure its active properties?

5°. Do ammoniacal salts and nitrates exercise a fertilizing influence after the first crop? What is the limit to the duration of the action of these salts?

It is easy to understand, that, on the simple assertion of these questions, their complete solution could not be obtained from the results of the experiments of a single year; that this solution can only be arrived at but by a series of annual trials conducted on a well-digested plan, in order to make them all contribute to simplify one of the most complicated problems in vegetable physiology.

The work that I have to-day handed over for the judgment of scientific men and agriculturists, is, therefore, but one more step towards the attainment of the object I had in view, in devoting the meadows which surround my manufactories at Loos to these agricultural experiments. In the following table I have recorded the trials made in 1844, putting opposite to each other the produce of hay and aftergrass. The trials were made, as were those of 1843, on a meadow of an uniform fertility and exposure. This experimental field had been divided into compartments of three ares * each, and separated from each other by a small trench; compartments destined to remain unmanured were left at different intervals, that they might serve as points of comparison.

The various substances employed in these trials were spread uniformly on the land on the 20th April 1844; the substances soluble in water were dissolved in 1000 litres; † the insoluble powders were sown broad-cast. The oil was mixed with hot sand, the sand thus impregnated, then sown. All the compartments manured with the powdered substances, as well as those receiving no manure, were watered with 1000 litres of water. This was done that all the compartments might be as much as possible in the same state of moisture. The weather during the growth of the grass destined for hay, was for the most part dry. After the harvesting of the hay crop, which took place about the end of June, the weather became rainy, and continued so up to 20th September, at which time the aftergrass was cut. After these crops had been rendered as uniformly and as perfectly dry as could be done in the open air, and under the influence of the sun, their several weights were determined with the greatest care.

The results of these trials will be seen in the following table:—

* An are is equal to 3·95 English perches.

† A litre is about equal to an English quart.

No.	KINDS OF MANURES EMPLOYED.	Quantity per hectare.*	Crops Obtained.			Increase.			Per cent-age of nitrogen in the manures.	Increase of crop given by 100 of nitrogen contained in the manures.
			Hay.	After-grass.	Total.	Hay	After-grass.	Total.		
		Kilogrs.†	Kilogrs.	Kilogrs.	Kilogrs.	Kilogrs.	Kilogrs.	Kilogrs.		
1	No Manure,‡	......	2427	1393	3820	......	......	......	......	......
2	Ammoniacal water of the Gas-works, 16,666 litres § of 3 degrees, saturated with the acid (hydrochloric acid) liquid in which bones had been digested, and containing some sal ammoniac,‖	333	6533	3373	9906	4106	1980	6086	26·43	6916
3	Sulphate of Ammonia,¶	250	3947	1617	5564	1520	224	1744	20·30	3436
4	Nitrate of Soda,¶	250	3864	1823	5690	1440	430	1870	15·74	4752
5	Nitrate of Lime, dry,¶	250	3367	2030	5397	940	637	1577	17·00	3710
6	Chloride of Calcium, ...	250	2417	1413	3830	......	......	......	......	......
7	Crystallized Phosphate of Soda, .	300	2693	1633	4326	266	240	506	......	......
8	Burned Bones, ...	800	2353	1300	3653	......	......	......	......	......
9	Gelatine of Bones,**	500	4180	2203	6383	1753	810	2563	16·51	3104
10	Peruvian Guano, ...	600	4090	2270	6360	1663	877	2540	4·98	8500
11	Do. Do.	300	3437	1966	5403	1010	573	1583	4·98	10595
12	Linseed Oil-cake, ...	800	2647	1773	4420	220	380	600	5·20	1442
13	Colza-seed Oil, ...	600	2393	1000	3393	......	......	......	......	......
14	Do. Do.	300	2687	1356	4043	......	......	......	......	......
15	Starch, ...	800	2267	1586	3853	......	......	......	......	......
16	Glucose, (Starch Sugar,) . . .	800	2333	1114	3447	......	......	......	......	......

* An hectare equal to 2 acres 1 rood 35·4 perches English. † A kilogramme equal to 2 lbs. 3¼ oz. av. English. ‡ Mean weight of the crops of the unmanured compartments. § A litre is equal to 1 quart English. ‖ Three degrees indicate the density of the liquid by Béaumé's areometer. This liquid from the acid bones is from glue manufactories, and contains the phosphate of lime of the bones. ¶ Equal to 95 per cent of pure dry salt. ** Equal to 90 per cent of dry gelatine.

If we examine these results with a view of solving the questions proposed in the foregoing part of this paper, we arrive at the following conclusions.

First Question—Does the quantity of nitrogen of a manure, independent of the mineral substances, always determine the degree of activity this manure ought to exercise upon vegetation? What are the circumstances in which the influence of a manure is not proportional to the quantity of nitrogen it contains?

The activity given to vegetation by the nitrogenous substances, is in proportion to the quantity of nitrogen that these products contain. This conclusion can be admitted so far as relates to those substances which do not contain mineral ingredients in their composition, and, if the necessary mineral food of the plants is sufficiently abundant in the soil; but, as soon as the nitrogenous substances are associated with fixed bases, it becomes necessary to concede their action, and certainly we find a proof of this necessity in the fact, that the same weight of nitrate of soda produced an increase of crop almost as large as the same weight of sulphate of ammonia; yet it contains only 16.57 per cent of nitrogen, whilst sulphate of ammonia contains 21.37 per cent.

This difference of action may possibly be attributed to a too rapid decomposition of the ammoniacal salt, caused by the presence of chalk, which forms part of the active soil, and consequently the loss of a certain quantity of carbonate of ammonia, which escaped into the air; but other results incline us to the opinion, that the influence of the soda has been sufficiently powerful fully to justify the observed results.

The different states of humidity and heat must cause the results produced by the nitrogenous manures to vary considerably, independent of the mineral matters they may contain. In order to observe their relative action, it is expedient to compare the ammoniacal salts among themselves, and this is what we have done in 1843. Then, we saw that he muriate of ammonia and
sulphate of ammonia produced
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thus 300 kilogrammes of Peruvian guano gave, of hay and after-grass, an increase of 1583 kilogrammes, whilst double the weight of guano only gave an increase of 2540 kilogrammes; the crops of 1845 will shew us whether the manure has been entirely exhausted. We have already proved that the increase of the crop has not been increased in a greater proportion in the after-grass than in the hay crops. It is, therefore, difficult to admit that, beyond a certain limit, the crops remain in proportion to the quantity of nitrogen; allowance must be made for the volatilization or the washing away by the rains of a portion of the manures which are not immediately assimilated by the plants.

It is, besides, advisable not to apply to the growing plants too great a stimulant by the abuse of manures. Thus in one of the trials, No. 2, recorded in the foregoing table, where the vegetation was extremely vigorous, the grass was too thick, the growth was sudden, the stalks never hardened, and, to prevent the grass from lodging and rotting under foot, it was necessary to have it mowed before it had arrived to maturity. These great inconveniences were even continned to the after-grass.

Second Question—Do nitrates, used as manures, owe a portion of their action to their base, or must we consider their action as determined, if not exclusively, at least for the greater part, by the nitrogen of their nitric acid?

The nitrate of soda appears to owe the greater part of its action as a manure to the nitrogen it contains in its acid. The results recorded in the preceding table prove that when the nitric acid is saturated with lime, its action on vegetation is still great, although a little feebler than before.

We have already had occasion to observe, that it is difficult not to admit, that the nitrate of soda partly owes its fertilizing influence to its base, which saturates the organic acids on the
mposition of the nitric acid. This acid, under the disoxydat-
nce of the putrid fermentation, is doubtlessly converted
before being assimilated by the plants.
n remarked that the soda of the sulphate of soda,
e in my experiments of 1843, produced no effect,
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can conclude, from all the trials that

have been made, that the bases of the nitrates contribute less to the fertilizing of the land than the nitric acid, especially if the question be of an immediate and perceptable action.

Third Question—The intervention of phosphates in vegetation cannot be disputed, since these salts always exist, and often in large quantities, in the ashes of plants. Must we infer from this, that these salts, taken by themselves, are to be considered as active agents in fertilizing the soil? or is their influence subordinate to the existence of the nitrogenous products?

If we consider the question of manures as it affects vegetation in its normal state; if we regard the circumstance, which the analyses of the ashes has fully established, that most plants contain inorganic salts, particulalry phosphates, we easily infer that the atmosphere, which is the receptacle of all the ammoniacal effluviæ that are produced, ought continually to furnish to vegetation all the nitrogenous elements that are necessary for them; and that the question which ought most particularly to engross the attention of agriculturists, is the restoration of the losses which the land annually sustains in the saline mineral substances, especially phosphates and silicates, &c., that are removed by the crops.

This opinion will find very few opponents from the moment the question is well put; but, at the same time, all chemists will be agreed to acknowledge, that the most powerful stimulant that can be applied to vegetation, consists of nitrogenous substances, when the saline aliments are present in the soil in a sufficient quantity, which is generally the case. All our trials lead us to think, that when manures are made a question of practical economy, when the problem to be solved, is not now to maintain the equilibrium, so as to enable the different plants to be produced indefinitely on the same soils, but to develope an exceptional vegetation, a vegetation in some measure forced. This can only be arrived at by the use of nitrogenous manures, especially when, in a system of a rotation of crops, the same plants do not re-occur till after the interval of some years. No doubt these manures, if they are not accompanied by the saline principles which form a constituent part of the plants, will, in time, render some soils incapable of producing certain vegetable productions; but, in considering the question in this point of view, I think that, in supposing that the exhaustion in the soil of those mineral substances, necessary to vegetation and to fructification, can be produced in the lapse of time more or less distant, it ought to awaken an anxious care in the breast of the farmer to restore to the land all that it can return. This last is of present interest; the other question involves a future interest equally to be respected in a social point of view; but this cannot

be the view in which the farmer, who generally is but a tenant, will consider the usefulness of a manure. No doubt the manure the most proper to be employed for the present and future welfare is that, which, in giving to vegetation an abnormal activity, at the same time restores to the soil those mineral substances which crops are likely to draw from it; but it is not less evident to me, that the manure of the most immediate activity is the nitrogenous manure. Ammoniacal or nitrated manure, which, as I have shewn in a former paper, acts not only by the nitrogen which the plant assimilates, but also by the mineral constituents, of which it causes a more abundant absorption, by giving activity to vegetation, and perhaps by facilitating the decomposition of certain insoluble salts, which are thus placed in a condition to be appropriated by plants.

We should in vain endeavour to cause, by the use of mineral substances containing no nitrogen, an activity of vegetation equal to that which the nitrogenous manures can produce for a certain length of time, and until the available mineral substances are exhausted from the soil.

It appears to me that the question of the manures ought to be hus stated; and, to support my opinion, I have only to compare the degree of activity given to vegetation by means of nitrogenous salts, (nitrates and ammoniacal salts,) in the trials made at Loos in 1844, and the results obtained by the use of phosphates. These last substances have scarcely given appreciable results in a single year's crop. The phosphate of lime of bones has caused no increase. The phosphate of soda has only given an insignificant increase, even which might be attributed to accidental circumstances; as the differences are not much more than those observed on comparing with each other the productions of the divisions that received no manure. There would not be, then, a sufficiently marked result to prove that the phosphate of soda had exercised an active part in stimulating vegetation.

In publishing this second account of our agricultural experiments, we are already able to announce that the results of our trials, included in the programme for 1845, shew that if the influence of the phosphates and other saline substances in general, which enter into the composition of the ashes of plants, be slow and difficult to be fully established in the returns of a single crop, this influence, however, is not less sure. It differs from that of the nitrogenous products, as it diffuses itself over a greater number of years, and that the states of the atmosphere exercise a greater influence over it.

Fourth Question.—In the customary organic manures there exist non-nitrogenous substances. Do these substances act an important part towards fertilization; or, in other words, do there exist

manures, composed of non-nitrogenous organic substances, which are susceptible of some energy of action? For instance, does the oil of the oil-cake give this manure its active properties?

None of the non-nitrogenous organic substances, employed in my trials, gave any increase to my crops. Was this caused by their decomposition being more slow, or that they are incapable of stimulating vegetation? This is a question that my experiments are, as yet, unable to completely solve; but henceforward it will be known that their action is very limited

In every instance, this influence cannot be absolutely denied: the non-nitrogenous organic substances, during their decomposition, produce carbonic acid and vegetable earth, and if their action is not comparable to that of the nitrogenous products, their efficacy, to certain limits, caused by the gases resulting from their decomposition, and by the carbonaceous residue which they leave in the land, cannot be denied. This carbonaceous residue, at least, has the advantage of rendering the land lighter, and by the dark colour which it also gives to it, permitting a more ready absorption of heat, and causing it to retain for a long time the volatile nitrogenous elements, either by the carbonaceous matter absorbing them as they are formed, or by the ulmic acid saturating the ammonia.

But in opposition to these advantages, cannot the decomposition of these non-nitrogenous organic substances, if they are in too great abundance, exercise a pernicious influence? In the absence of nitrogen, the decomposition of these substances give off acid products under the action of which vegetation cannot fail to languish: no doubt, this is the reason why peat-earth only produces favourable results when it has been previously mixed with lime. In the usual manner of using stable manure, the acids produced by the non-nitrogenous organic substances are saturated by the ammonia which the nitrogenous substances give off.

We have seen that the sugar of starch has, not only not produced an increase of crop, but has even given a negative result. We can attribute this difference to the action of the acid given off by acetous fermentation; but this difference is too slight to permit us insisting on this point, it may proceed from some unperceived circumstance.

Be this question as it may, it is henceforward sufficiently proved that sugar, by itself, cannot constitute a manure; nevertheless, at a time when molasses from the beet-root sugar could not find a sale at the distilleries, and at a time when the price of these molasses was reduced below five francs per 100 kilogrammes, many farmers used them to manure their land. This practice would appear to be completely condemned by the results of our trials; however, we must not lose sight of the complicated com-

position of the molasses of the beet-root sugar: we find in them, besides the saccharine matter, many saline substances, particularly nitrates and ammoniacal salts.

Oil does not appear to act more efficaciously than the other non-nitrogenous substances; besides its slow decomposition is opposed to an immediate and energetic action.

The oil-cake itself did not act very quickly, because the oil with which it is impregnated retards the decomposition of the other substances of its composition. This is the reason why many of the Flemish farmers have adopted the practice of causing their oil-cake to undergo a change by fermentation before spreading it on their land; they generally dilute it in the liquid-manure tank.

It would appear, then, that the oil-cakes almost exclusively owe their fertilizing properties to the nitrogenous substances they contain; and we cannot fail to think that this manure brings too large a price when compared with the prices of all the other nitrogenous products. According to the analyses of Payen and Boussingault, 100 parts of oil-cake of colza, dried, contain 5·50 of nitrogen and 4·92 in its ordinary state of moisture. Therefore, only taking into account the nitrogen contained in the manures, 8 parts of oil-cake would exercise a fertilizing influence equal to 100 parts of ordinary farm-yard dung. Making this the basis of calculation, the value of oil-cake as a manure ought not to exceed eleven or twelve times that of farm-yard dung. Now in Flanders, where so great use is made of oil-cake, a cart-load of dung weighing 2000 kilogrammes is worth from 9 to 10 francs, and the value of 100 kilogrammes of oil-cake is often so high as 18 and even 20 francs, that is to say, forty times the price of farm-yard dung. Nevertheless we may add, that, in the actual state of our knowledge of the theory of manures, the relation which exists between the quantities of nitrogen cannot, to a certainty, indicate the relative value of manures. Thus, in the foregoing comparison, independently of the action which we can attribute to the non-nitrogenous organic substances—an action which, at least, can be attributed to the formation of acids and carbonaceous matter which tend to fix the ammonia—we must take into account the many different saline substances contained in the farm-yard dung in a far greater quantity than in the oil-cake which is to replace it.

In the neighbourhood of Lisle the farmer makes a distinction between the oil-cake of the town and that of the country; he gives the preference to the latter, because, being manufactured by the less powerful presses of the windmills, they retain more of the oil than the oil-cake made in the manufactories where the presses are driven by steam power. This preference, justifiable, no doubt, when the oil-cake is destined for the feeding of cattle,

ceases to be so when the oil-cake is intended to be used as a manure for the land; in this latter case the advantage is incontestably on the side of the oil-cake out of which the oil has been entirely expressed, and in which, consequently, the nitrogenous substances are proportionally more abundant.

Some direct experiments have shown me the presence of from 15 to 17 per cent of oil in well pressed oil-cake, which a digestting with ether easily extracted. If this oil could be extracted to the profit of some branch of industry—to a state of soap for example—the value of the residue, of which the quantity would be diminished by the weight of the extracted oil, would not be diminished in its fertilizing action on the land. In some experiments, the object of which was to make soap from the oil of the oil-cake, I experienced a very great difficulty in the operation: the decomposition of some of the nitrogenous substances, and their consequent formation into ammonia, even under the influence of a very slight elevation of temperature.

As to the extraction of the oil from the oil-cake, I merely mention it here as an economical problem, leaving the solution of it for future researches.

I will not finish concerning the influence of the non-nitrogenous organic substances on the fertilizing of land, without discussing the question of the formation of ammonia. During putrid fermentation of these substances, by the fixing of the nitrogen of the air and the hydrogen of the water, thus forming ammonia, a formation to which it has been endeavoured to attribute a great part of the efficacy of the artificial manures prepared from woody substances containing but little nitrogen. The formation of ammonia under the abovementioned circumstances, is considered an incontestable fact by many chemists. The researches of Hermann on the fixation of the nitrogen of the atmosphere during the rotting of woody matter, will support this opinion. It is desirable, however, that new and clear experiments should be made. The de-oxidating influence of the fermentation may place the air contained in the water, wherewith the substances in a state of fermentation are impregnated, in conditions favourable for the combination of the nitrogen, at the moment in which it is set free, with the hydrogen of the water itself, or with the hydrogen issuing during decomposition from the organic substance; we daily see the nitrogen of the atmosphere fixed in a state of ammonia when the slow decomposition of water takes place. This is what evidently takes place during the formation of rust. We are, besides, well aware of the property of porous substances, and charcoal in particular, of absorbing gases, and consequently to assist their reciprocal action and combination; nevertheless, it appears to me that so important a fact as the formation of ammonia from non-nitrogenous organic

substances, during their fermentation, ought to be supported by numerous and decisive results, instead of resting on one single observation, on probabilities, and on analogies. For this formation of ammonia will be the foundation of all manufacture of manures, and the circumstances which facilitate it will require to be studied with the greatest care for the interests of our agriculture, for which the problem of the fixation of the nitrogen of the air contained in the manures is the great problem.

Fifth Question.—Do ammoniacal salts and nitrates exercise a fertilizing influence after the first year? What is the limit of the duration of the action of these salts?

The answer to this question will be fully found in the table of the results of the trials made in 1844: 250 kilogrammes of nitrate of soda, gave an increase in the hay crop of 1440 kilogrammes, and in the after-grass of 430 kilogrammes; 250 kilogrammes of sulphate of ammonia gave an increase in the hay crop of 1520 kilogrammes, and of after-grass of 224 kilogrammes.

In order to be enabled to answer the question as to the products of the second year, I harvested and made into hay in 1844 the grass produced, without the addition of any new manures, on that portion of ground on which the experiments of 1843 had been made. The experiment has shown me, that when we use a considerable quantity of ammoniacal salt the influence can be perceived, but only in a slight degree, in the second year. The influence exercised by the gelatinous solutions appear, generally, to be of a longer duration: an hectare of the meadow which, in the spring of 1843, had been manured with 21,660 litres of the gelatinous solution, containing 2½ per cent of gelatine, after having given in 1843 an increase to the hay crop of 2480 kilogrammes, gave also, in 1844, an increase of 540 kilogrammes.

The horse urine, the nitrate of soda, and the ammoniacal salts, did not give, in the second year, results differing in any sensible degree from those obtained from the unmanured portions.

Thus, the influence of those salts containing nitrogen, either in their acid or in their base, when used in the quantities employed in my trials—viz. about 250 kilogrammes to the hectare—does not sensibly extend beyond one year, giving place to two crops of grass, which, in truth, are of the most exhausting kind.

Economical considerations.—When, in considering these results, we examine the utility of the application of ammoniacal salts and nitrates as manures, with regard to their present prices, we arrive at the following conclusions.

Sulphate of ammonia sells for 52 francs per 100 kilogrammes; now, 250 kilogrammes of this salt having cost 130 francs, gave an increase in the hay crops of 1520 kilogrammes, and in after-grass 224 kilogrammes; and valuing the hay at 7 francs and the after-

grass at 4 francs per 100 kilogrammes we obtain a return of 115 for 36 centimes, which gives a loss of 14 francs 64 centimes. 250 kilogrammes of nitrate of soda, the cost of which was 48 francs per 100 kilogrammes, gave an increase in the hay crop of 1440 kilogrammes, and in the after-grass of 430 kilogrammes, which at the above rate will give 118 francs, consequently a loss of 2 francs.

It will be scarcely necessary for me to add, that these relative prices are liable to many changes, according to the variations in the prices obtained for the produce, as well as in the cost of the saline substances used as manures; and that the above figures only refer to the present experiments, as was the case with those which I obtained from my work of 1843, and consequently do not apply to other situations.

It is, nevertheless, an important conclusion to draw from these observations, that we are very near the time in which the price for sulphate of ammonia will permit the use of this salt in agriculture to raise crops at a less expense.* With sulphate of ammonia costing 46 francs per 100 kilogrammes, the increase in the hay and after-grass would pay the price of the salts.

No doubt, in a short time the openings afforded for the manufacture of sulphate of ammonia from putrid urine, or from the water used in the condensation and purification of gas, will reduce the price of this salt to the above rate, and then its consumption will have no limit. Till then, agricultural industry will derive most advantage from the use of the ammoniacal waters of the gas manufacturers after their saturation by an acid, or, what is better, after their decomposition by gypsum, by chloride of calcium from the glue manufactory, by impure copperas, by chloride of manganese, &c. It is thus that I have made, for many years, excessively active and economical manures.

HINTS FOR OBTAINING THE FINEST HONEY WITHOUT DESTROYING OR STARVING A SINGLE BEE.†

THE object of these hints is to show to Scottish bee-keepers

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* All my experiments were made on a clay soil. The conclusions which I have been able to draw from the results obtained, only refer *absolutely* to soils of this nature. It will be easily understood that a calcareous soil may cause a too rapid decomposition of the ammoniacal salts, and the consequent volatilisation of the carbonate of ammonia.

† The writer's attention was first directed to this subject by Cotton's "Short

how they can obtain the finest honey without destroying or starving a single bee.

Almost every one has observed that the finest honey is found in one or two combs at the opposite sides of the common straw hive, and at the upper edges of the other combs; and that the remainder of the combs, which form three-fourths of the whole, is of a dark-brown colour. The pure white appearance of the sealed honey in the centre of the hive is superficial, and arises from the new film of wax which covers the cells. This dark colour of the combs is caused by the droppings of the bees, and particularly by the skins left by the worms or larvæ in their transformation into the perfect insect. Now, by the plan to be described, all the honey taken from the hive is of the first or purer sort; the other, or brown honey, is left for the winter food of the bees. Indeed, before any honey can be taken away, the bees must have stored up as much as an ordinary straw hive contains, and of this store they are never deprived; so that the objection that has been sometimes started by asking, whether it be not better, on the old plan, first to murder and then to rob, than on this new plan, first to rob and then murder—by starvation—does not at all apply to this system. It is only what is superfluous that is taken away from the bees; and, more room being given for extending their works, this superfluity in good seasons will be found far to exceed what most people imagine—so much as thirty pounds' weight being the average quantity taken from each of five hives in 1846. Upon this plan even the bee bread, so bitter and disagreeable, is seldom or never met with; while the combs obtained are so large and so free from all impurity, that they may be cut and eaten from side to side, as a piece of the purest preserve, without leaving a particle of refuse. This cannot be affirmed of one half of the honey that is generally presented at table, after being extracted from the hive upon the common but cruel method of bee management. Having once seen and tasted the fruits of it, most people have become converts to this modern plan of bee preservation.

The plan of management to be illustrated and recommended in these pages, may be pursued either by using wooden boxes or

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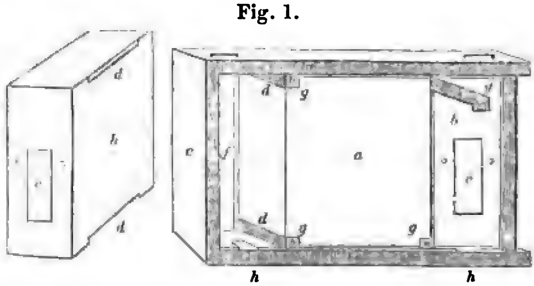
and Simple Letter to Cottagers," (now published in London by the Society for promoting Christian Knowledge,) falling accidentally in his way. He afterwards procured Nutt's "Humanity to Bees," "Taylor's Bee-Keeper's Manual," and Cotton's larger work, "My Bee-Book." Hence it will be seen that he claims no credit for originality, or for any peculiar degree of feeling for innumerable creatures needlessly destroyed; but that he is animated by a desire of making the method recommended by these authors more generally known, and of introducing it in a modified form, which, from experience, he considers to be one better adapted for Scotland.

ordinary straw hives. The former is unquestionably the better method, and will be the first described. As under the best possible management a swarm will die without any apparent cause, it would be well that every one should have two or three old stocks or swarms that have survived the winter before he begin to work upon the system of boxes. This, without much expense or disappointment, will secure for it from him a fair trial; whereas, if he began with only one swarm in his possession, and it, being all his stock, should die or continue weak for a season, the whole plan is denounced or thrown up as visionary.

Bee-Boxes.—Before the swarming season commences, one, two, or more sets of boxes are to be procured from any carpenter, who will make them at a price running from ten to twenty shillings a set, according to the quality of materials and finish put upon them. The simplest and cheapest form in which a set of boxes for one swarm can be made, may be stated as follows.

Fig. 1.



A set of bee-boxes consists of four parts, viz. one middle, fig. 1, *a*, two side-boxes, *b*, and the outward case or covering *c*. All of these parts should be constructed of as good and well seasoned wood as can be had, and if possible without joinings in the wood that forms their sides. The midde box *a*, is to be thirteen inches high, and eleven inches wide on the front, back, and two sides, as measured on the outside. The two side boxes *b*, must be exactly of the same height as the middle box *a*, and also of the same dimensions, so as to fit and stand closely to each side of it; but the breadth on the front and back of these side-boxes is to be only five inches, or about half that of the one that stands between them. The top, the front, and the back of the middle box should be made of inch thick deal, and its two sides of half inch. It requires no bottom, but must be firmly nailed, screwed, or tenoned together. All parts of the side boxes are to be made of inch deal, except that side of each which is to stand next to the middle one, and which may be made of half-inch deal. Slits or holes *d*, seven inches long and half an inch deep, are to be made —one at the top on a level with the roof, and the other at the bottom of the middle box, with corresponding openings in the side-boxes—as passages for the bees. In the middle of the back of each of the side-boxes *b*, a window *e*, about six inches long

and two wide, is to be placed, the glass being fixed close to the inside edge of the hole made for it. Around the front of the middle box, a slight frame or moulding *f*, two inches broad and half an inch thick, is to be put, flush with the edge of the box at top and bottom, but projecting half an inch at each side, so as to prevent the side boxes moving too far forward. In this projecting part of the frame, two slits, one at the top and the other at the bottom, are to be made close by the side of the middle box, and at least half an inch deeper than the open passages, so as to hold a slip of tin, zinc, or iron plate. These slips *g* are to be passed in from behind between the boxes, in order to cut off, when required, all communication between one box and another. The slips for the top openings may have their upper edge bent at right angles, so that the flange or bent part may run on the top of the middle box as a guide and support. The whole four slips should be an inch longer than is necessary to reach from the front to the back of the middle box, including the frame, and therefore twelve and a half inches long—this additional inch to be bent at right angles, and to have a small hole in it, so that it may be pinned to the middle box, to keep it from shifting from the passage that it is intended to cover. Three of these slides *g* are shown shut, and the fourth half drawn out.

The outer case or covering *c* is to be made of inch deal firmly nailed together, painted on the outside at least, and of a size to contain the three boxes when standing close beside each other, with half an inch to spare at the back. The bottom of this case is double, or has an upper one of half inch deal nailed on across the grain of the under one, so as to prevent warping. The door of the case may be either of one loose piece fastened on with snecks, or of two parts hinged. The roof and lower board of the bottom should project at the back one inch, to receive the door between them.

The door or entrance to the hive is made three inches wide, and a quarter or three-eighths of an inch deep, and is cut out in the centre of the front of the case, and on a level with the upper side of the thicker or lower bottom. To complete the passage a bit of the upper or half inch bottom, three inches by one, immediately opposite the entrance, is to be removed. A landing-board, six or seven inches square, is to be attached to the door on the outside of the case; and a small back-door *h*, two inches wide and three deep, is to be made, and filled up with a moveable plug in the upper or half inch bottom, and under each of the side-boxes.

A swarm of bees may be put into the middle box *a*, in the same way as they are hived in a common straw basket, by rub-

bing the inside with a little honey or sugar and water, and placing the box closely over the bees on the branch or place where they have clustered. Although there be no cross sticks in the box, they will hang firmly without them. When the bees are well up in it, the middle box is to be replaced in its proper position in the inside of the case, and the whole removed as quickly as possible to its permanent station, where it may stand at the same height from the ground, and on the same sort of supports as common straw hives do.

Should the season be suitable, and the swarm strong, the middle box will be so well filled with honey and young brood in two or three weeks, that the slides on one side may be withdrawn, and the bees admitted to work in the side box. They will begin this the more readily, if two or three small bits of comb be fixed, by melting their edge in the flame of a candle, and quickly fixing them in this state to the roof, and parallel to the sides, so as to give the combs, of which they are the nucleus, the greatest breadth.

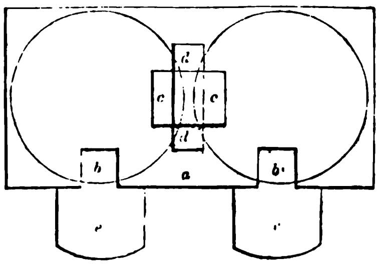
The progress of the combs downwards will be seen through the window in the back, and, when they have reached the bottom, or when the bees begin to cluster at the door of the hive, the slides on the other side should be removed, and access given the bees to the second side box. When the combs appear to be pretty well filled in the first box, or when the whole, or a portion of the honey in it is to be taken out, replace the two slides, and thus cut off all communication with the middle box, and then draw out the plug *h*, leaving the door of the case open. It will be found, that in the course of a day or two, or occasionally in even a few hours, that the bees will make their escape through this opening, and return to the middle box by the door in front, and thus leave the side box, with its contents, to be removed, without giving any annoyance. After the honey is taken out of it, the box is to be replaced in the case; and the slides may be withdrawn whenever the other side box appears nearly filled. This second box is to be treated in the same way as the first.

It may happen that the queen bee, which almost invariably keeps within the middle box, may have strayed into the side one, when it is about to be taken off. Then the bees will not leave the side box, and others from the hive will come and join them by the back-door. In this case the slides are to be withdrawn again for a day, by the close of which the queen will have most likely returned to the middle box.

Common Straw Hives.—Honey, pure as from boxes, may be also obtained from the common straw hives. For this purpose, let a foot-board, fig. 2 *a*, be made of a size sufficient for two

straw hives to stand side by side upon. It is to be made double; that is, the under part of one inch deal, and the upper of half inch, both firmly nailed together, so as to prevent warping. Doors, *b b*, three or four inches square for each of the straw hives, and a passage, *c c*, six inches by four, are to be formed, by removing portions of the upper or half inch deal. In all cases where straw hives are used, it is preferable to make the entrance in the foot-board rather than in the straw hive itself. When the lowest ring of straw is cut through for a door, the whole hive is much weakened, and the size of the entrance cannot be so well regulated at the different seasons, as when it is made in the wood of the foot-board. Lay a piece of stout sheet or hoop iron, *d d*, eight inches by two, across the passage between the hives, sinking it so as to be level with the upper surface of the foot board, and to leave sufficient room for the bees to pass underneath. A like bit of iron may be placed over the entrance to the hives; and landing-boards, *e e*, six or eight inches square, attached to each of them; or, if moveable, one landing-board will do for the two entrances.

Fig. 2.



Place the hive containing the bees on one end of the board, in the position of one of the circles drawn in fig. 2, shutting up the passage *c* until the beginning of summer. Then this passage may be opened, and another straw hive, of the smallest size used for second swarms or casts, with a piece of comb fixed in the top, placed in the position of the second circle. Shut up the door of the first hive. This will oblige the bees to come through and return by the common passage, and by the door of the empty hive, in which they will soon begin to work. When the bees begin to cluster about the door of the second hive, it is an indication that they have stored it pretty well with honey, and that it ought to be removed, and another one, if not too late in the season, put in its place. This removal is best effected by carrying it to some distance in the earlier part of a warm forenoon, when most of the bees are abroad. Those that are removed with the hive, if the queen be not with them, will soon leave it. But should they gain an accession of numbers from the older straw hive, it should be replaced on the board next day, and left for twenty-four hours, by which time the queen may have returned to her old quarters.

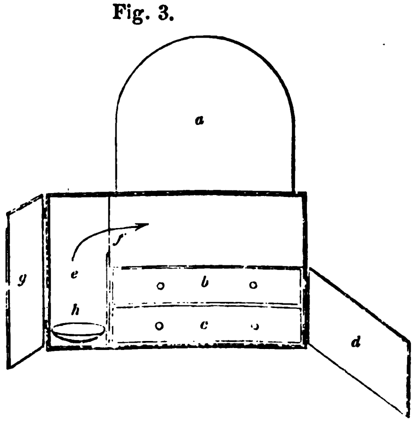
By this method the clumsy one of eiks at the bottom is

superseded, a good proportion of the finest honey is obtained, and, above all other accommodations, the lives of the bees are preserved. At the end of autumn the hive may be placed on a smaller foot-board, or remain where it is on the larger one, the side passage being shut up, and the front entrance opened as at first.

To Smoke, but not Suffocate Bees.—For those who will adopt neither of the two preceding plans, there is still a third left, by which they may have the whole honey, good and bad, and yet save the lives of the bees—by removing them from their own hive, and joining them to the bees in another. It seems to be well ascertained that the same quantity of honey, twenty pounds weight or upwards, that will support one ordinary swarm through the winter, will be sufficient food for two; that within certain limits the less populous the hive, the more honey is consumed; and that, where two swarms have been united in the end of autumn, the result is early swarming in the following summer.

There are several ways of effecting the complete removal of the bees from one straw hive to another; but it will be best accomplished by the following apparatus, consisting of two boxes, the one for smoking or fumigating the bees, the other for reuniting them.

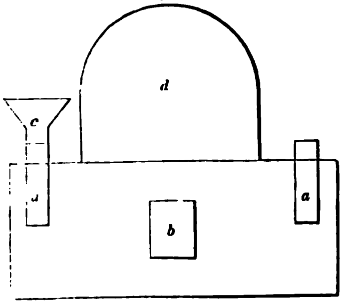
Fig. 3.



The *Smoking Box*, fig. 3, is to be made two feet long, one foot and a half wide, and one foot two inches deep, all outside measure. In one end of the top a hole, fourteen inches in diameter, is to be cut out, over which the hive *a* with the bees is to be placed. Should the hole be too large, then a slip board, with a smaller one so as to support the hive, may be put between the box and it. Immediately under this hole, and at the bottom of the box, two slight drawers, *b*, *c*, are to be placed, each sixteen inches square and three inches deep, having a door, *d*, to close over them. Six inches of the other end of the box are to be partitioned off; the lower part of the partition to be formed by the support for the sides of the drawers, and the upper portion of perforated tin or zinc, or of wire gauze, to allow the smoke from the apartment *e*, to pass to the hive in a direction indicated by the arrow *f*. This apartment has also a door, *g*.

The *Union-Box*, fig. 4, is to be made two and a-half feet long, sixteen inches wide, and one foot deep, with a hole in the centre of the top, fourteen inches in diameter. Within three inches of each end a tin or zinc tube, *a*, *a*, six inches long and two and a-half in diameter, is to be fixed, with one end projecting one and a-half inch above the top of the box. These tubes are to have corks or lids to close their upper end, when necessary. A small window or grating, *b*, may be made of perforated tin or wire gauze, in each side of the box, to admit fresh air, and glass windows in the ends.

Fig. 4.



On the previous evening, or early in the morning, before any of the bees go abroad, place the straw hive, from which they are to be removed, on the smoke-box, fig. 3, and the hive to which the bees are to be added on the union-box, fig. 4, taking care that none escape from either. Then, instead of smoking with sulphur, which suffocates and totally destroys the bees, use the smoke that arises from a burning piece of that common fungus found in meadows, which is known by the name of "puff-ball," "frogs' cheese," and "snuff-boxes," and which in different species (of Lycoperdon) varies from the size of an egg to that of a turnip. Gather "them when half-ripe—the largest are the best. Put them in a bag, and when you have squeezed them to half the size, dry them in an oven or before the fire. The fungus is fit for use when it will hold fire like tinder."—*Short and Simple Letter to Cottagers*, p. 4. "In the absence of fungus I have tried other substances, and found nothing better than common blotting-paper several times doubled, placing between the folds a portion of tobacco-leaf. Saturate this in a solution of nitre, (saltpetre,) a small tea-spoonful dissolved in a pint of water, and dry it before the fire. Divide the paper into small pieces when used, and it will readily light, and produce smoke abundantly."—*Taylor's Bee-Keeper's Manual*, p. 84.

A piece of fungus, or of the paper as thus prepared, is to be lighted and placed on a saucer, *h*, fig. 3, or over some live coals, or the flame of a candle. The smoke, being shut in by the doors, will soon stupify the bees, and cause them to drop down upon the upper drawer, *b*, which, when a good many of them have fallen, is to be taken out, and the door, *d*, closed upon the opening. If the queen should be among the fallen, pick her up and keep her by herself. The bees are to be swept with a feather

from the drawer into the funnel, *c*, fig. 4, placed on the top of one of the tubes, *a*, in the union-box, on which stands the hive, *d*, to which they are to be added. In a few minutes, if the smoke be still ascending, the second or lower drawer will have another parcel of fallen bees. Then replace the upper drawer, *b*, and withdraw the lower, *c*, putting its contents—taking care that the queen is not among them—into the other tube of the union-box, and so on until no more bees are observed to fall. So many of them, however, will be fixed in the cells and between the combs, if the hive be large, that it will be necessary to withdraw the smoke, and keep the door, *g*, fig. 3, open until they revive, and are heard burring and moving about. After this, the same process may be repeated, until there is not a bee left. The bees will soon revive in the union-box, and begin to ascend its sides. To assist them in ascending, small slips of wood should be placed between the floor of the union-box and the edge of the hole cut in its top. The hive should not be removed from the union-box until twelve hours at least after the last considerable portion of the bees were put through the tubes, or until it is thought that the two swarms are mingled and settled together. Then, when it is replaced in its old site, the queen belonging to the smoked hive may be put in at the door, "when, if any accident has happened to their own queen, they will gladly take in the stranger to reign over them."—*Cotton.*

As these boxes for smoking and uniting swarms are used but seldom, a pair of them might serve many apiaries, and be held in common by a considerable neighbourhood. They may be used when a straw hive gets so old and rotten, that the bees cannot be longer kept in it with safety, for transferring them either to another straw-hive or to a set of bee-boxes. In the latter case, the bees as they fall may be put at once into the side-boxes, and then, by the removal of the slides, allowed to mingle with those in the middle box, the front entrance to which being shut for twelve hours after the addition is made. By this mode of smoking, or stupifying the bees, any portion of old and musty combs may be removed, and the interior of the hive examined at any time, with impunity to the investigator, and without the death of a single bee.

Miscellaneous Hints.—Many variations in the construction, and improvements in the finish of the boxes and foot-board will occur to those who see and acknowledge that part of the economy of the honey-bee on which this modern plan of management is founded. A few are given here, but for many others the treatises already mentioned must be consulted; while for much valuable information on bee management generally, reference may be

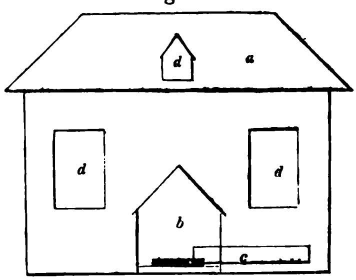
made to the *Naturalist's Library*, Vol. vi., the venerable author of which, however, seems to have been unacquainted practically at the time with the modern and improved plan now advocated.

In place of having only two side-boxes, some spare ones may be kept in reserve. This will permit of the first filled being laid aside with their contents, which is by far a better way of preserving the combs until used at table, than by cutting them out at the time when the side-boxes are removed.

If the weight of each box, when empty, be marked on it, then, by a simple re-weighing when full, the amount of honey will be known at once without extracting it.

A moveable roof may be made, as represented in fig. 5, *a*, or in any other shape, so as to carry the rain beyond the side of the case. A porch, or covered passage, *b*, at the entrance of the hive, four inches deep by six wide, may be attached. It will save many of the insects when they alight from being blown off or injured by the wind and rain. At the back of this porch, and close upon the entrance of the hive, a piece of perforated tin or zinc, *c*, should be made to slide, regulating the size of, or wholly shutting up the door, and admitting at the same time air sufficient for ventilation.

Fig. 5.



A window, three or four inches square, may be placed in the back of the middle box, and tin shutters may be hinged upon it, and upon the windows of the side-boxes. The outer case, *c*, fig. 1, may be made four or five inches higher than the boxes, and a hole, one and a-half or two inches diameter, bored in the top of the middle box. This hole will be found useful at times for returning to the hive any bees that may have fallen in the snow, or become benumbed with cold; or for placing upon it, early in the season, a small glass for the purpose of getting it filled with the first spare honey. The whole parts of the boxes, except the inside, and the whole of the case, except the floor, may get two or three coats of white paint; and outlines of windows, *d*, *d*, may be drawn, so as to make the hive look neat and ornamental.

Instead of placing the straw hives side by side, as shown in fig. 2, the foot-board, *a*, may be easily constructed so as to admit the second or empty hive, being placed in front of the first or full one. In this case, when the second hive is added, what was the entrance to the first becomes part of the passage between the two. If the foot-board be placed back one-half its length, the

bees, finding it on the same spot, at once use the entrance to the second hive as they did that to the first.

Or, the foot-board may be made of two instead of one piece, and the landing-board, *e*, made moveable, so as to suit either of the two pieces. Care, however, must be taken, that they do not shift when put together, so as to lessen or obstruct the common passage between them. A small box may be used instead of a second straw hive.

Ventilation, or a free current of fresh air, through the side boxes, has been strongly advocated by most writers on this mode of managing bees, and several methods for securing this have been pointed out by them. But the little creatures, particularly at the time that ventilation is most required, so actively and unceasingly fill up every opening, that it becomes very troublesome, nay, impossible for many, to attend to the removal of the materials filled in by the bees. When there is some spare room always kept in one of the side-boxes, which is easily done, and when he principal entrance is large and open, the bees appear to suffer ittle or no inconvenience, except perhaps when the outward temperature rises very high, from 78° to 84°. Thermometers have also been put into the middle box opposite the window; but they are of little general use, and are suitable for those only who may be experimenting upon, or very narrowly watching the economy of the hive.

The simplest plan of ventilating the side-boxes is by making a hole about an inch diameter over the window, and fixing a bit of perforated tin or wire-gauze across it on the inside. A plug or cork may be used for shutting up the hole in cold weather; and, when it is removed, the small openings can be easily cleared by a pin or small quill. Still more to promote ventilation in the side-boxes, the plug, or piece of wood at the bottom, *d*, fig. 1, may be withdrawn, and a piece of perforated tin fixed across the opening, the door of the case being removed, or left partially closed.

Under the protection of a veil, or a piece of gauze-cloth of any open texture, and armed with a pair of stout leather gloves, the most timorous may with impunity, and fearlessly, intermeddle with the bees in all that is necessary to be done to them in this mode of management. Indeed, except in very rare or irritating occasions, most people lay aside even these means of defence; habitual practice soon showing them that many of their former fears were groundless.

Long lists have been given of plants affording food for bees. In Scotland, the white clover and the common heath are the staple sources· and the most suitable place for bees is where a supply of each can be had in its season, within a circle of two or

three miles diameter—bees having been found in fine weather collecting their sweet treasure from the common heath, in wild districts where there was not a bee-hive kept within four miles.

The snowdrop, crocus, particularly the blue one, and all the earliest flowering garden plants, may be cultivated in the immediate neighbourhood of the hives; and a few of the early flowering willows, those plants of them that bear the pollen or little yellow balls of dust, may be also introduced with much profit. The elder-tree is well adapted for giving them a supply of this needful food for their young after the willow flower has faded. Butter-burr, or the common and hybrid tussilago, borage, *Phacelia tanacetifolia*, which, though an annual, continues when once introduced, being self-sown, and mignionette, may be selected from among a host of plants as the most serviceable to bees.

Having always room given them for work on this plan, the bees do not swarm by any means so frequently as when confined in a single straw hive. They will, however, throw off at times a colony, which, if the parent hive be weak, should be returned—by letting the swarm get up into an empty straw hive or box, and towards evening shaking them out at the mouth of the hive they had left. If the parent hive can afford to give off a colony, it may be hived and put up by itself, either in a set of boxes or in a straw hive.

If the estimate be confined to the product of any one season only, there may not indeed be so large an amount of honey obtained from a certain number of stocks, as might perhaps be taken from them on the old plan. But this new plan, by keeping up or increasing the number of stocks, will, in the course of a few years, come to yield a much greater quantity than any other can supply. Yet, were the quantity much less than it is, the quality enhances it in the estimation of all who have seen it; while the fact, that the busy insects that gathered it were still alive and provided for, sweetens the honey to the palate of the humane and merciful, and enables them to eat it with a relish never felt before.

THE FARMER'S NOTE-BOOK.—NO. XV.

Report of the Agricultural Chemistry Association for 1846.—There are portions of this Report which we think may be of interest to the general reader.

Work in the Laboratory.—The analytical investigations conducted in the Laboratory divide themselves into two classes—the one class consisting of analyses of soils, manures, &c., which are sent for examination, and on which reports of a scientific and practical nature are drawn up by the Chemist; the other comprising matters of research, which are undertaken for the advancement of science and of the arts. During the six months under review, the analyses of the first description amounted to 103, and of the second to 116. The following table shows the details of analyses for each half of the past year:—

ANALYSES MADE IN 1846.

	From January to July.	From July to December.	Whole Year 1846.
Soils and clays,	25	30	55
Guanos and other manures,	65	27	92
Refuse of Manufactories,	4	4	8
Marls, limestones, and corals,	26	29	55
Ironstone,	9	...	9
Specimens of rocks and other minerals,	4	4	8
Waters,	7	9	16
	140	103	243
ANALYTICAL RESEARCHES.			
Organic—			
Analyses of the parts of plants,	41	25	66
Determinations of nitrogen in plants,	6	11	17
Inorganic—			
Analyses of the ashes of plants,	27	78	105
... ... coal,	...	2	2
	214	219	433

Under the head of analytical researches in the above table, are included many analyses, both organic and inorganic, of the potato, in reference to the prevailing disease. The greater part of these has been embodied in an essay upon the subject, presented to the Highland and Agricultural Society, and for which the Society has awarded a premium of fifty pounds. This essay is published in the (present number of the) Transactions of the Highland Society.

Such analytical researches as these are the principal means by which the Association hopes to promote the second object for which it was established, namely, the *extension* of our existing knowledge. The pressure of other analytical work on the part of the Members of the Association prevented the devotion of so much time to this subject in 1844 and 1845 as during the past year. The Committee are satisfied, however, that the more the Funds of the Association allow this branch to be prosecuted, the greater will be the benefits it will confer upon scientific agriculture.

All the analyses, agreeably to the practice of the Laboratory, are carefully recorded; and the book in which entries of them are made is now submitted for the inspection of Members.

Besides the correspondence connected with substances transmitted for analyses, a duty requiring considerable time and reflection devolves upon the Chemist, in replying to the numerous letters which are addressed to him by Members of the Association, seeking advice to aid them in the pursuits in which they are engaged. The letters of this description, received since the 30th June last, were as follows:—

July, ...	65
August, ...	76
September, ...	45
October, ...	55
November, ...	20
December, ...	65
	326
January to July, per last half-year's Report,	461
Total Letters in 1846,	787

This twofold correspondence, comprehending reports on substances analysed with practical remarks, and suggestions offered in cases wherein analyses are not resorted to, the Committee are disposed to regard with much interest; and they consider it well calculated, at once to show the utility of the Institution, and to promote the interests of its Members who avail themselves of its advantages. In illustration of the facility with which the benefits held out by the Association may be turned to account by landlords or tenants, and in the hope of encouraging applications for the services of the Chemist in this department of his labours, they have much pleasure in bringing to the knowledge of Members the subjoined letter, addressed to the Honorary Secretary by one of their number, distinguished by his zeal and ability in the cause of the Association:—

"It has often occurred to me, that proprietors and tenants who are Members of the Agricultural Chemistry Association would more frequently consult Professor Johnston as to the best

method of increasing the fertility of their land, did they know the way to set about it. With some also there seems to be a doubt, that they might apply in vain for advice of much practical value.

"It would serve to remove these difficulties were you to publish in your Half-yearly Reports, or otherwise make known the advice which, in particular cases, has been actually asked and obtained.

"With the view of promoting this object, I shall now briefly mention an application lately made by me to your Chemical Officer, and the information and suggestions which I, in consequence, obtained from him.

"One of my fields is bearing this year turnips, which are much infested with the disease called fingers and toes. Last winter I put furrow-drains into the field, at a depth of from 3 to 3½ feet. It had previously been kept in grass for many years, but the grass was coarse and scanty.

"Being desirous of trying whether I could obtain from your Officer any suggestions for improving the fertility of this field, I sent to the Laboratory a box containing samples of the soil taken from three different parts of it. Two of these samples indicated the average nature of the soil, the other was from a moorish and very barren part. At each of these places, about two handfuls of soil were taken from the surface, and from the respective depths of 8, 20, and 30 inches.

"In the course of ten days, I received analyses of my soils, with a letter from the Professor, containing suggestions founded on the analyses. The following are the points which he brought under my notice:—

"1. That the soil contained to a depth of 30 inches in the moorish part 0·54 per cent, and in the other parts from 0·44 to 0·63 per cent of carbonate of lime.

"There was here a great deficiency of lime, which at once accounted for the disease in my turnips.

"The Professor recommended, therefore, a considerable admixture of lime, which I intend to apply next spring, to the extent of about 15 tons per acre.

"2. That the lime should be applied on the moorish part in a caustic state, and on the rest of the field in the form of compost.

"This special advice was founded on the circumstance of there being 6·45 per cent of organic matter in the moorish part, and only from 3·78 to 4·45 per cent in the rest of the field.

"This organic matter, originating, as it probably did, in the decay of marshy grasses, (for the analyses showed 18·96 percentage of water in the moorish soil, and only 14·45 per cent in the other,) contains ulmic and other acids, which are (as is well known) injurious to the roots of grain crops, and require to be

neutralised by lime, which, by their action, is readily converted into food for plants.

"In the rest of the field, the deficiency of organic matter will be rectified by the lime compost.

"3. That there is a deficiency of alkaline salts, on which account the Professor recommended that the lime should be slaked with salt and water, to the extent of giving 2 cwt. of salt to the acre.

"4. Farther, I may mention, that there is a soda-water manufactory near my farm, the refuse of which, said to consist entirely of gypsum, I heard that the owner was disposing of very cheaply. The price he was asking, and generally obtaining, was five shillings per ton, and one shilling to one shilling and sixpence for the barrels containing it. I obtained a bottle of the refuse and sent it to the Laboratory, for the purpose of ascertaining whether it would be for my advantage, as apparently it was, to obtain a considerable quantity, even though I would have to cart it four miles.

"The refuse was in a state of pulp, and was formed by the mixture of sulphuric acid with chalk, the combination producing a disengagement of the carbonic acid gas from the chalk. The result shows strongly the practical utility of such preliminary inquiries.

"In a few days I received an analysis, informing me that the soda-water refuse contained no less than 70·16 per cent of water; moreover, that the mixture when dried contained, out of 100 lb., only 56·55 lb. of gypsum, and 39·24 lb. of chalk, the rest being earthy matter. The relative proportions, therefore, in 2240 lb., or a ton of the refuse, were—

Water,	1571 lb.
Gypsum,	377 lb.
Chalk,	262 lb.
Earthy matter,	30 lb.

"But pure gypsum, I was informed by your Officer, could be obtained at thirty-five shillings per ton, 377 lb. of which, therefore, would cost only five shillings and tenpence, whereas 377 lb. of the gypsum, offered to me by my soda-water friend, would, including barrels, have cost from six shillings to six shillings and sixpence; and his gypsum could not be obtained without carting, and putting on my land with every ton of it, more than 4 tons of water.

"It is scarcely necessary to add, that I declined availing myself of this *cheap* purchase of gypsum; and, at the same time, I told the apothecary that were he to apply more sulphuric acid to his chalk, which chalk he was importing from England at a great

expense, he would not only not be throwing so much of it away, but he would make his refuse more serviceable to the farmer.

"On the proper mode of applying the lime refuse of a gas-work near my farm, I have also received useful advice. But on this and other points I need not dilate. I think that I have already said enough in this letter to show the practical utility to proprietors and tenants of such analyses as your Laboratory affords."

Visits to Districts.—The districts in Scotland to which visits have been made by the Chemist, since the last Half-yearly Meeting, are the Shires of Argyle, Inverness, and Perth; and the lectures and addresses delivered in them have varied with the exigencies of the occasions and places of delivery. Elementary prelections have now been addressed to audiences in all parts of the country; and, while they have been the means of imparting as much information as was compatible with their scope, the hope may be cherished that, in a still higher degree, they have been instrumental in exciting a taste and relish for the science which it was one of their objects to recommend. They have been serviceable, also, as a stimulus to scientific agriculture; from which permanent results, beneficial to the country, can hardly fail to accrue. The same plan of procedure cannot, however, be repeated, and it is a subject of anxious consideration to the Committee to determine what arrangement can most advantageously be substituted for it.

In visiting the different districts, the attention of Professor Johnston appears to have been particularly arrested by what fell under his observation in the counties of Inverness and Argyle; and his views, with reference to the past and present condition of that portion of Argyleshire which comprises the peninsula of Cantyre, are exhibited in the following letter which he has addressed to the Committee:—

"Among the several parts of Scotland which I have visited during the latter half of this year, I have been most struck with some districts in the shires of Argyle and Inverness. At the southern extremity of the former county towards the end of the peninsula of Cantyre, and at the head of a bay of the same name, stands the town of Campbelton. Though situated in a highland country, and separated by a rough sea from the lowland districts, this has, in reality, for many generations, been a lowland town. Peopled by the descendants of settlers from the low country, who had taken refuge there during the times of religious persecution, its inhabitants have been active, industrious, and enterprising,—a race totally distinct from those of the rural districts, and rarely intermarrying with them. They are the principal owners of nearly thirty distilleries, and possess the greater part of the local influence, with the exception of that which naturally

centres in the Duke of Argyle, as the superior of the town, and the principal proprietor in the district.

"To the west of Campbelton, and across the peninsula to the western sea, stretches an extent of low flat land known by the name of the Laggan. Widening as we proceed westward,—bounded by hills to the north and south, and exhibiting, here and there, little islands of richer cultivation, lifting themselves from twenty to fifty feet above the general level,—this low land has evidently, at no remote period, been an arm of the sea, perhaps a strait—opening wide towards the west, and communicating by a narrow channel with the bay of Campbelton.

"This conclusion is confirmed by the fact, that, at various depths, recent shells, and especially the *Cyprina islandica*, well preserved, are met with in the middle of this flat land.

"The character of the soil, also, is consistent with this view. It consists of islands of clay land, formed by accumulations of muddy sediment, while the whole was under water—of ridges and hills of almost naked gravel, of various heights and sizes, thrown up in the more troubled parts of the estuary, or as successive beaches when the waters were receding—nearer the sea, of downs of drifted sand, partly siliceous, and partly composed of comminuted shells, thrown up by the sea, and drifted by the wind;—and between and among these three varieties of solid land of a wide extent of moss of uncertain depth, filling up the beds of ancient lakelets left by the retiring sea, or formed by the waters when dammed back by the embankments of drifted sand.

"The geological history of this district is interesting, both as accounting for its physical appearance, and for the character and agricultural capabilities of its clays and gravels,—the surface of the Laggan indicating very nearly the actual or former extent of a deposit of oolitic rocks, white sandstones, dark shales, coal, and perhaps limestone, which are here found resting upon the old-red sandstone and the older slates.

"Along this part of the Scottish coast, the old-red sandstones have, in a great measure, been removed by the action of the sea. But the oolitic rocks are still softer and more easily worn away. Exposed in this spot to the full force of the Atlantic, brought by a north-west wind past the Mull of Oe in Islay, they gradually yielded, crumbled down, and gave place to the ancient lake or estuary which more recent changes have caused again to disappear. Hence the clays of this flat consist chiefly of the debris of the shales of the oolite, with some small additions from the adjacent slate rocks—the gravels chiefly of the rolled fragments of the oolitic sandstones, mixed with those of the old-red sandstone and of the harder slate rocks—and the sands of the commingled siliceous particles of the oolitic and old-red sandstones. Though

limestones occur among the slate rocks, especially to the south of the Laggan, few fragments of such rocks are to be found among the rolled gravels which are spread over its surface.

"In this flat country the agricultural capabilities are great, and the improvements which have recently been made upon it and the neighbouring land are very striking.

"The lower slopes of the hills which bound it are naturally fertile, as they often rest upon or are composed of the debris of old-red sandstone rocks—and the higher clay lands which rise among the moss, have long yielded occasional heavy crops. The gravelly soils have willingly grown potatoes and bere, and occasionally turnips; and the naked moss, when kindly treated, has shewn itself capable of giving a profitable return.

"But progress in this district was slow till within the last ten or fifteen years. Up to 1830, the potato was almost the sole agricultural export from Campbelton, and the money returns were sufficient to pay nearly the whole rental of the district. Since that time this export has been gradually decreasing, and in consequence of a change in the husbandry, other products have been substituted in its stead.

"I have said that though a Lowland population occupied the town of Campbelton, they did not intermingle with the native race, and communicated, therefore, little of their energy to the rural population. As is still the case in many Highland districts, this part of the population was poor, and usually in debt to their landlords. With little knowledge, they had little hope, and little energy. They improved little, perhaps, because they did not know how. They were accused of obstinacy and indolence—and indeed so frequently manifest them that many have come to think, erroneously I believe, that these qualities are inherent in the blood of the Celtic race. At all events the tenantry in this part of Cantyre were far from being comfortable, thriving, or happy; they gave much trouble also, and anxiety to the proprietors, and it was exceedingly desirable that some change should be introduced.

"The method adopted was to introduce lowland farmers as the old tenantry died out, became insolvent, or emigrated; to consolidate two or three farms into one, to build better houses, to convert a considerable portion of the old exhausted land into permanent pasture; to replace the Kyloe by the Ayrshire cow; and to introduce a dairy instead of a potato husbandry.

"Though a country like this could scarcely be expected to hold out inducements to the best class of Lowland farmers, yet so superior a body of practical agriculturists has been gradually introduced, that the appearance of the country is undergoing an entire alteration. A new spirit and energy appear among the

agricultural classes; they pay larger rents, and more punctually than the former tenantry, and yet they are more thriving and happy. They live more comfortably, and have their houses and farms in better order. They are sensible that much may yet be done for the land they occupy, they believe it may be done with profit to themselves; they are, therefore, full of hope, and very desirous of information as to the safest and most economical methods of improvement. In my lectures to these farmers I took the liberty, among other observations specially applicable to the subject, of pointing out to them the value of a cheap manufacture of pipe-tiles for draining their stiffer soils; of Mr Smith's peat-drains for their flat mosses; of a compost of peat with their abundant lime, for the gravelly and sandy tracts; the importance of saving the liquid manure, which I saw in many places running to waste, and the use of the peat earth for this purpose—the profit of a higher manuring upon their barley and turnip soils—the composition and value of the refuse of their numerous distilleries—and the advantage that would arise to the district from the establishment of a bone-mill. I have no doubt that the same skill and energy, by which the changes I have already alluded to have been brought about, will gradually lead to the adoption of these methods of local improvement also. It is to the exertions of Mr Stewart of Strowan, the Duke of Argyle's chamberlain, that much of this improvement is to be ascribed.

"I cannot leave this locality without remarking upon the striking illustration it gives of the power of knowledge and its use to all classes of society. The former race of farmers upon this land could not pay a small rent, and live free from debt. A more instructed race succeeded them, pay larger rents, and live comfortably. By the increase of knowledge among this tenantry, the income of the landlord is increased; while, by the larger produce raised, more people are fed, and the internal peace and material power of the country are augmented. Thus, that diffusion of knowledge among the rural classes, which is one of the objects of our Association, is manifestly an object of importance to all classes of the community.

"But to the rural classes themselves, the present occupiers of the soil, it is of more immediate interest. That which is taking place in Cantyre, will happen in every other district where the desire for knowledge becomes stagnant, and improvement long stands still. Better instructed men will succeed to their farms, and they or their sons will be dispossessed. How important, therefore, that they should keep pace with the advance of knowledge, if they desire to retain the station they at present occupy, or to raise themselves higher in the scale of society."

The Benefits which the Association is capable of rendering.—In the advanced state which the agriculture of this country has attained, and in the urgency for further improvement, arising from the extended competition which recent political measures are calculated to produce in the supply of the great articles of human subsistence, such an institution as the Association acquires fresh importance, and becomes more than ever necessary to the prosperity of the Agricultural Interest. Chemical analyses of soils and plants throw much light upon the arcana of nature in the departments of her kingdom to which they respectively belong; they illustrate the relation which subsists between them, as regards the processes of vegetation; and they afford essential aid in ascertaining the kind and quantity of substances that are required by given soils for the production of specific crops. The known principles, too, of chemical action, in resolution and composition, serve to explain facts which experience establishes in practical husbandry; while they elucidate the causes of the diversified, and more rarely opposite, effects which sometimes follow similar applications, and which, without the explanation that Chemistry furnishes, would be likely to issue in discouragement and perplexity. The advantages of chemical analyses have been extensively experienced in the prevention of imposition, and in the right appreciation to which analytical investigations have led, with respect to different articles offered for sale as potent manures; and they have, likewise, been conspicuous in shewing the absolute and comparative value of divers descriptions of food for use in rearing and fattening cattle.

It ought never, however, to be forgotten, that the researches of the Laboratory alone will not yield sufficient data for the formation of a sound theory, either of agricultural management, or of feeding stock. There must, in addition, be an accumulation of carefully observed and accurately recorded facts, derived from experience of the actual occurrences which take place in the conduct of the farm, and of the feeding-house. It is from the combined results of practical observation and scientific research, that just systems of practice may eventually be deduced; and the realization of this desirable consummation will largely depend upon the assistance which able and scientific men shall receive from intelligent men of practice.

Experiments in the Field.—In the published proceedings of the Association, and in previous reports, attention has been drawn to the refuse matters of bleach-works, as well as to other waste materials; and experiments have been suggested for testing their value to the practical farmer. A letter has been received from Mr Pringle, at Ingram Farm, near Lisburn, in Ireland, describing some interesting and successful experiments of this kind, in which

the waste leys of a bleach-work were found very advantageous, in conjunction with farm-yard manure, in promoting the growth of turnips. The subjoined results are deduced from the statement in the letter, as having been obtained from the experiments tried:—

	Bulbs.		Tops.		
	Tons.	Cwt.	Tons.	Cwt.	
Dung alone, . .	17	5½	8	14	per acre.
Dung and Guano, .	26	18½	8	1½	do.
Dung and Waste Leys,	33	12¾	7	12½	do.

The interesting difference in the weight of the tops, when the leys were used, appears to be connected with the large quantity of alkaline matter contained in the waste liquour; and, so far as the experiment goes, the liquid seems to influence the growth of the plant more in the bulb than in the leaf—a very important fact, if further trials should confirm it.

Conclusion.—In concluding their Report, the Committee mention, with regret, that, owing to impaired health, Professor Johnston was obliged to apply for leave of absence from Durham during the winter session of his lectures in the University of that city. The desired permission was readily granted, and the Professor repaired to the Continent; from which, the Committee are happy to say, he has now returned in improved, though not perfectly restored, health. He has collected much valuable information; and, as the Association will be gratified to learn, he was received with distinguished kindness in Holland, where his scientific and practical attainments are held in much estimation, and where, in compliance with pressing solicitations, he delivered two lectures at the Hague, on the Agriculture of the Netherlands, in its connexion with Science. A society, for the promotion of scientific agriculture, was formed immediately after the delivery of the lectures, on a basis, in most respects, similar to that of the Association; and Professor Johnston had the honour of naming the first Professor, and of designating his duties. No more convincing proof could be afforded of the high appreciation of the example which the Association has set, in seeking, by the light of scientific knowledge, to elucidate the processes of nature and art in the nutrition and growth of plants, and to advance the national welfare by means of an Economic Agriculture.

Composition and Effects of Decomposable Manures. By MR TOWERS.—The subject of Manure appears to be inexhaustible; it has been treated of by men of the first order of science, and examined in all its bearings, while the merely practical farmer has gone on in the ordinary routine, applying decomposable substances to the land, which experience has taught him, as well as the most enquiring philosopher, to consider the *pabulum* of vege-

table life, the restorer of land deteriorated and impoverished by vegetable crops.

Of late years, the theory of nutrition by *the absorbent powers* of the leaves has rapidly advanced, and now we can hardly take up a paper or periodical, wherein the imbibation and assimilation of carbonic acid are not spoken of as facts established upon conclusive evidence.

I am not prepared, nor do I desire to impugn this doctrine; but I may be permitted to question its accuracy, simply because the plants, or portions of plants, which have been made the subjects of experiment were either placed in unnatural situations, under glass, exposed to sun, and frequently surrounded by gases foreign to their constitution, or they consisted of parts and mutilations, and detached from the parent stem, and thus utterly deprived of any connexion with the roots. A cutting is in truth a member of a vitalised body that will act in a manner wholly different from its original. Let such a member be placed in any coloured infusion, and it will imbibe that fluid, and exhibit the tint thus absorbed partially throughout its entire length. But let a perfect small plant of the same kind, growing in a pot of the most simple earth, be watered daily, or as required with the same fluid, and then no colour whatever will pass through the organism of the roots. I have tried this experiment repeatedly, and suggested the results to the late eminent Mr Knight, who at once admitted the fallacy of all results obtained by experiments with mutilations. Thus, also, rooted plants or suckers, examined *under water* covered by bell glasses, exposed to the influence of a glaring sunbeam, cannot reasonably be expected to exhibit any of the natural phenomena of vegetable vitality. The *modesty of simple doubt* may then be permitted to those who cannot wholly assert to all that has been asserted.

To drop this subject, which I consider to be, on the present occasion, merely introductory to the notice of another subject established upon far more certain evidences—we will come at once to the *Composition and Effects of decomposable Manures*, as applied to the soil. The following owe their origin to the perusal of a very interesting Essay by M. Girardin, profound in its reasoning, and to which they will serve as a commentary.

Our essayist takes for his basis, that ordinary manure which is obtained from healthy stall-fed cattle, to whom an abundant upply of good food, partly dry partly green, is given, the animals eing also supplied with a sufficient quantity of litter to absorb he excretions.

An important question is here presented—“ What is the best tate in which manure can be employed—is it better to allow it o ferment or to lay it on the land at once?” To answer this

question, the component parts of dung coming immediately from stables must be understood.—This fresh manure is a gross mixture of straw and other vegetable refuse, which have been used as litter, with the solid excrement and urine. Fresh manure which has undergone scarcely any fermentation, contains the following substances:—

Water,	75
Soluble vegetable and animal matter, and salts	5
Insoluble do., Insoluble salts, Vegetable fibre and straw,	20
	100

Reduced by long fermentation to black "spit-dung"—manure according to Boussingault contains—

Water,	72 20
Organic soluble matters, and soluble salts,	1·50
Insoluble salts,	10·27
Straw converted into peat,	12·40
Finely divided peaty matter,	3·63
	100.00

Here the water is decreased by 2·80 parts in the hundred, but the vegetable matter is changed to the condition of what is termed "*peat.*" To say nothing of the dissimilarity of reduced manures dependent upon the components of the excrements, and the activity, greater or less, of fermentation in the masses, I should be inclined to substitute the word *humus* for that of peat, a substance which is formed by the long protracted decay of very old vegetable masses. However, either the one or the other will furnish a decisive proof of the invaluable corrective qualities of quick or shell lime.

I have, on many occasions, taken advantage of the excellent article published in this Journal, some months since, on *Lime*, and its reclaiming influences, by Mr Rowlandson. My own experiments, founded on that article, were conclusive, and one or two of these I shall again adduce, as open to every one, and therefore more likely to be useful. *Humus*, and *humic acid*, were terms generally in vogue some years since, and employed to express those substances formed by long decay, and which were supposed to be the *prepared food of plants*: hence, old spit-dung, very rotten leaves and wood, and the black matter of heath-mould, or moor-peat whereon "heather" grows, were supposed to represent humus.

If any one of these substances be digested, hot or cold, in a watery solution of pearl ash, soda, or ammonia, particularly if in a caustic state, the colouring matter will be extracted, and the

alkali become more or less neutralized. Caustic ammonia excels in this extracting and combining power, and it is the basis most appropriately applied, because, by combination with that part of humus which is called *humic acid*, the pungent ammoniacal odour is subdued, and thereby furnishes a sensible proof of the neutralising process.

The dark fluid thus obtained, resembles that of the liquid manure, which floats abundantly to waste in five-sixths of the farm-yards of England; and both one and the other are affected by quick-lime, or even by strong lime-water, in the way now to be described.

Suffer the brown ammoniacal humate to stand after being drained from the substance digested, till the liquid become clear as possible; do the same by the drainage from a dunghill; place a cupful or more of it in a deep glass vessel, and stir into it a small quantity of powdered lime, or pour in so much lime-water by slow additions, as long as it throws down dingy grey flocks. Stir the former vessel, and then let both settle, and thus proceed till the lime and the lime-water produce no further change, and then the results will be an almost total destruction of colour, leaving the liquid of a pale hue. That wherein lime-water was used will have a sediment below it, more floculent, but less in quantity, because the matter deposited is a pure *humate of lime;* whereas that in the other vessel combines with it the surplus or excess of powdered quicklime.

To render the experiment conclusive, take any of the substances named, and rub into them about the same proportion of powdered lime as was used in the first operation; then pour so much boiling soft water over the mass as will make it fluid, and enable it to deposit the muddy sediment. The floating liquid will then be pale—wholly void of that deep porter colour which was produced by the three alkalies before named. The lime, therefore, has combined with the humic extractive, fixed it as an insoluble humate, and in a condition to be acted upon by soil or by the roots of plants by slow degrees.

Thus then, lime is a corrector—one which combines with, and fixes redundant vegetable matter, or at least that portion of it that is in any degree soluble in water, or in the solution of soda, potash, and ammonia; and by the substantiation of this great fact, the fixture of the nutrimental quality of humus and humic acid has been proved, and the reclaiming power of lime upon old inert mosses and peat-bogs, established upon philosophical principles.

If it be admitted that lime acts beneficially upon surplus vegetable matter, and in peaty or rushy bogs, chiefly by the paramount affinity which it possesses for *humic acid*, the advocates

for a very moderate degree of fermentation in the masses of dung, acquire a strong position, since it is obvious that a protracted fermentation terminates in the production of a cold humus mass, which consists of little else than black carbon, effete inorganic matters, and the said humic acid, soluble in the saline alkalies, but fixable by the action of lime. But, independent of the final conversion of manure into a substance replete with matter injurious to crops, the loss sustained in actual bulk is very great, amounting to at least one-fourth. From observing the decrease of a common hot-bed five feet high, the dung of which cost at the first purchase 7s. per two horse loads, I should infer the loss to be much greater; for in the space of a year this depth of farm-yard dung was reduced to little more than a foot, and in substance, to a moderate cart load. Davy insisted upon the efficacy of absolutely fresh dung, and thought he had prevailed upon the late Lord Leicester to adopt the use of it at Holkham. He, however, was to a certain extent under error, as Mr Coke himself assured me by a letter, wherein he detailed the method employed to form his compressed manure mass, which, subsequently, obtained the name of the Norfolk pie.

Numbers of agriculturists are practically acquainted with it, but others may be curious on the subject; therefore, I refer to the letter itself, which, however, it is extremely difficult to decipher.

"My custom is to carry out all the manure made in the separate yards during the winter, as opportunity may offer, into the fields intended for turnips, calculating the quantity at ten loads per acre. In the first instance, I make a platform of earth, (to receive the manure,) and then I cart over it a proportion of cow-dung, which I deem to be the weakest manure, upon that pig, which I hold to be the best, then some from store and fold cattle, followed by horse dung, and then more of the pig, always compressing the heap by carting over it. Then I plough round it, and throw a light coat of earth over the top and sides to keep it from fermenting. It remains in this state to within a fortnight of sowing the turnips, when I turn it over, and in its fermented state it is put into split ridges of 27 inches, the ground turned over it by the plough, and the seed sown immediately after."

This method of preparing a mixen, produces a certain degree of fermentation, while it tends to confine the gases that are extricated; it produces, also, that slight degree of internal action which M. Girardin alludes to, as required in order to "destroy the cohesion of the vegetable fibre, predisposing it to a decomposition and solution, which is useful to manure before spreading it on the land." But like all other attempts to regulate a movement, which is always progressive when once excited, it is subject to

great uncertainty. Every vegetable and animal substance deprived of the vital principle, is from the same moment brought into a state of decay, or slow combustion; and when with such substances we combine others replete with nitrogen, like the fecal and urinous excretions, all blended together more or less in the straw-yards, the byre, stables, and cow-shed, and of necessity requiring a lapse of time, and exposure to varying atmospheric influences, it will be evident that no two compressed, or other compound masses, as above described, can be expected to become exactly similar in any given number of days.

In the essay, the evidences of Thäer, Schmalz, Hassenfratz, &c., have been appealed to; the chemist last named, it is said, "manured two similar lands, one with long dung in which the straw had only commenced to putrify, the other with perfectly decayed manure, capable of being easily cut with by the spade. These two lands were cultivated and sown in the same manner; the second produced larger, stronger, and more vigorous plants the first year, than the former; but the second year, when neither was manured, the former produced larger and stronger crops than the second: the third year the former still had a slight advantage over the latter."

"An experience of more than seven years," says Pictet, "has convinced me that we shall be great gainers by using manure as soon as it comes from the stables." "For six years," observes M. de Knoblesdorf, "I have followed these principles on the farm I cultivate; with the single exception of sheep's dung, all the others were conveyed to their destination and spread, even when the land was covered with snow, as soon as they were taken from the stable. It is to this circumstance that I attribute the good state, continually increasing, of my land as regards manure."

This experimentalist believes that the principal English and Scottish farmers with whom he has communicated are all agreed. "They have declared that, by theory and practice, it is decided that manure applied before undergoing fermentation, as it is brought from the stable, enriches the soil intended for the cereals and lentils. Its immediate application prevents a loss of more than a fifth of its weight. So all these farmers carry the manure *as it is formed* to the lands planted with peas, beans, vetches, &c.; they consider this practice so beneficial, that they anticipate that it will soon become general."

Such farmers there may be; but I confess I know not one farmer so brought up among the great body in and around this really arable district, who has attempted any modification of his manure heaps. One person—an amateur, and medical by profession—experimentizes and modifies; he farms some hundreds of acres, many of which have only a parching gravel as their staple; and is bold,

able, and on the whole successful; but we perceive no carting of fresh manure. One farmer indeed ventures at bones and guano, but further I cannot testify.

Upon the theory of recent and more decayed manure, it may be safe to venture a somewhat strong opinion, and it is this. The fermentation of urina-fecal excretions, blended with straw, must evolve a vast deal of ammoniacal gas, with hydro-carbon and watery vapour. Such manure ought (if it be possible to collect, and apply it absolutely fresh) to be buried, as in the garden, deep at the bottom of a trench, covered with ten or twelve inches of comminuted earth, into which all the gases would intersticially pass. Above this layer of earth the more reduced short dung should be laid, and ploughed in as in common manuring, after the ground over the new manure shall have become sufficiently firm. These processes, could they be carried out, would, to all intents and purposes, constitute a thorough heart manuring of the staple. Like *perfect draining*, they would bring the land into a condition which practice has not at present taught us to appreciate: but then there would be difficulties, that theory, however sound, could not anticipate. As it is, dung and long straw cannot be easily introduced; though were Mr Mechi's system of employing straw-chaff in his byres, &c., adopted, *that* inconvenience would be at once removed. The reader may, however, rest assured, that by placing a dense body of new manure deep in the ground, a permanent fund of enrichment would be created; for, after all the *pros* and *cons* which theory may advance upon the nutriment derived from the air, the ground *is*, and will be found the real laboratory of production. I contend not abstractedly for the old opinion, or *against* the absorbent power of the foliage: I only insist upon the fact, that the gases are most advantageously *prepared* in the soil, whence, whether they pass through the roots in the state of sap, or into the air, to be thence attracted by the leaves, is a matter of indifference. The ground, its moisture, the electrolytic action of the roots, constitute the grand apparatus of nature; and to these, under a wise system of application, which experience alone can teach, we would trust for the establishment of the most perfect system of economy.

But to pursue the continental evidences collected in the essay, M. Perrault carts his manure in a half putrified state, wherein the straw, having lain about six weeks in the heap, is easily broken up. His work is almost constant—thus he carries dung to the field in February and March for barley, oats, &c.; in May and June, to transplanted beet after rape, vetches, *trifolium incarnatum*, &c.; in July, to manure rape, transplanted beet and turnips; in August and September, for winter crops; and in the end of autumn, and at sowing time, as top-dress for wheat,

Marshal Bugeaud is a stanch advocate for fresh manure. He says—"Manure, when allowed to putrify for six months, loses half its fertilizing properties, whatever care may be taken to preserve it. When used at once, it causes a continual vegetation, and may be doubled in amount in the same time. The plants produced will restore to the farmer the principles they have drawn from the manure; whilst they themselves have drawn their nourishment in part from the atmosphere, they will afterwards, as fodder or roots, serve for the food of cattle."

M. Koerte, professor at the Royal Academy of Agriculture at Mœglin, in Prussia, adduces some experiments of Gazzeri, made by weighing, and which gave the following results:—

"After fifty-nine days, there remained of one part of manure"—(to simplify the calculation, call the unit 100)—"only 77·7, indicating a loss of 22·3, or somewhat less than one-fourth of the whole. And thus progressively, but always in a *decreasing* ratio, the most active decomposition occurring at its earliest stage." It was ascertained—and this is an important consideration, and one upon which doubt is expressed—that "less loss is sustained when manure is spread in layers on the land, and well pressed, than when in small heaps;" so that it is advantageous to to spread, and then roll it, when it cannot be immediately ploughed; but then, it cannot be so rolled without its adhering to the roller.

M. Gasparin considers it a complete illusion on the part of those who, deceived by the intimate admixture of materials in old dung, conceive that it has acquired value: "by long fermentation it has lost nearly half its substance, more than half its soluble principles, and two-thirds of its nitrogen."

Schattenmann describes an excellent practice long employed in Switzerland. It consists in "saturating the ammonia of urine and dung with sulphuric acid, sulphate of iron, or gypsum" (sulphate of lime.) "No trace is thus lost of the active principles of the manure, because the sulphate of ammonia is not volatile, and manures treated in this way possess much greater fertilizing powers. All the farmers of Alsace who have adopted this method bear testimony to its value, and desire that it should be more extensively used."

I think that some caution should be exercised whenever pure sulphuric acid is added to liquid manures; for if the acid predominate, the fluid acquires an agent of great power, which is foreign to the soil, unless lime or chalk naturally abound, in which case gypsum is instantly formed. It is yet astonishing how much concentrated acid a urine-tank will take up. I lately tried its effect on a quantity of diluted urine in a tub containing 30 gallons, and observed the most violent effervescence and frothing whenever the pure acid was poured on the surface. I made no exact

calculation, but believe that three gallons of the liquid took from four to six ounces of acid of the gravity 1·83. The fetid odour was immediately subdued. The additions of each were made whenever some of the contents of the tub were carried off.

I extract but one more paragraph; it refers to the *quality of manure* which should be chosen for the several crops of the farm. "It should be remembered that each plant contains particular salts, which are necessary to its growth; thus all the grasses and corn have a large quantity of silica in their *stems*, and of alkali and earthly phosphates in their *seeds;* tobacco, pease, clover, and the stems of the potato, contain much lime and magnesia, while turnips, mangold, potatoes, contain much alkali in their leaves and stems. If, then, these plants do not find the requisite quantity of these salts in the soil, they cannot be expected to thrive. The best mode of restoring those salts is to bury the residues of the former crops as manure. It would be very useful to employ the herbage and stems of rape, buck-wheat, " (*Query*, beech-wheat, *Polygonum fagopyrum*,) " potatoes, &c., which are usually thrown away as litter, and to use the *manure made from them* for new crops of the same."

As the salts of the forage pass off with the urine and excrement of the animals fed on them, it is rational to presume that " the dung of pigs fed on pease and potatoes, the dung of cows fed on hay, and turnips, contain the necessary saline principles of grasses and turnips, that pigeons' dung contains all the saline principles of grain, that rabbits' dung contains those of herbaceous plants and legumes, and that the solid and liquid excrements of man contain those of all seeds in great abundance, and consequently, that they are useful to all crops, without exception, and are capable of taking the place of any other manure." My object in drawing up this summary is to do justice to the inquiring philosophic spirit which pervades the foreign agriculturists. Whatever may be said or thought of the defective management of farm routine, certain it is that there are men at work of profound ability, whose researches must lead to the best results. Let us improve upon them, while we testify gratitude for their labours.

Asses. By JAMES H. FENNELL, Author of "A Natural History of Quadrupeds."—From the genus *Equus*, which consists of the horse only, the genus *Asinus*, comprising the ass, zebra, quagga, djiggutai, &c., is distinguished by the tail having long hairs at the end only, where they form a brush, by the mane being short and erect, by only the fore-legs possessing warty callosities, by the markings being disposed in stripes, and by the greater length of the ears.

The migratory herds of wild asses, which inhabit at one season

the warm climate of Persia, and at another the southern parts of the Russian empire, are supposed to be of the same species as the common domestic ass employed in this more northern region. But the accounts of wild asses published by various travellers are so dissimilar, that we may almost question whether the original species of the wild ass has been satisfactorily ascertained, and whether several other species do not remain to be described. Bruce, in his *Travels*, (iv. 522,) mentions wild asses very like ours "in neck, head, face, and tail, *only their skins are streaked*," and as inhabiting the same parts of Abyssinia as the zebra. It is not unlikely that the ass thus indicated is an undescribed species. Bell, in his *Travels in Tartary*, (i. 224,) notices many wild asses like the common ass, except that their hair is "waived, white and brown, *like that of the tiger*." The species mentioned in Ainsworth's *Travels*, (p. 41,) and in Sir R. K. Porter's *Travels*, (i. 459,) is the khur, or wild ass of Persia, Arabia, and Mesopotamia, and is probably identical with that of Thebaid, and other parts of the African continent. It is also the *wild mule* of the ancients. It has a black mane, and no line along the back or across the shoulder. Allied to this would seem to be the herds of wild asses, entirely of a pale yellow colour, which Le Vaillant noticed in Southern Africa, and called by the Greater Namaquas *the white zebra*. Lastly, there is the kiang of Thibet, or Himalayan wild ass, described in Moorcroft's *Travels in the Himalayan Provinces*, (i. 311.)

The wild ass of Thibet, which principally inhabits Kutch, on the Indus, although known to Aristotle, Pliny, Ælian, and other ancient naturalists, appears to have remained scarcely known in Europe until Pallas described it in the memoirs of the Russian Academy, under the name of the jikta, or *Equus hemiones*. This animal seems to have a very wide geographical range, being found in Mongolia, Arabia, the Himalayan Mountains, and many other parts of the continent of India. Blumenbach tells us that the wild ass is found at present principally in Tartary, where it is called *kulan*, and whence in autumn it emigrates in herds southward, towards Persia and India, where it passes the winter. Morier, in his valuable *Second Journey*, says, "it is common to the whole of Persia, although its proper soil is Arabia," and he relates that—

"On the desert before we reached Casvin, in the grey of the morning, we chased two wild asses, which the Persians call *gour khur*, but which had so much the speed of our horses, that when they had got at some distance, they stood still and looked behind at us, snorting with their noses in the air, as if in contempt of our endeavours to catch them. The Persians sometimes succeeded in killing them, but not without great dexterity and

knowledge of their haunts. To effect this, they place relays of horsemen and dogs upon the track which they are known to pursue, and then hunt them towards the relays, when the fresh dogs and horses are started upon the half-exhausted animal." This agrees with Xenophon's statement, that their horsemen had no other means of catching them than by dividing themselves into relays, and succeeding one another in the chase. He mentions the wild ass in several places, and includes it among the beasts fit for the chase.* Buffon, who says it does not differ from the domestic ass except in its attributes of liberty and independence, thinks that it, and not the zebra, (whose native soil and climate is South Africa, in the countries bordering upon the Cape of Good Hope,) is the onagre of ancient history.† The wild ass is of a light mouse colour, with a dark streak over its shoulders and down its back; its head is large, and its gait is much more light and lively than that of the common ass. It is of a most obstinate nature, and seems to be extremely refractory under any restraint. This wildness and love of liberty, which characterise the animal, are beautifully described by the prophet Jeremiah:—"A wild ass used to the wilderness, that snuffeth up the wind at her pleasure," (ch. ii. v. 24.) Again, when their image is allied to all the horrors of a parched desert:—"And the wild asses did stand in the high places; they snuffed up the wind like dragons: their eyes did fail because there was no grass," (ch. xiv. v. 6.) Dr Turton considers the wild ass spoken of in Job (xxxix. 5, 8) to be the zebra.‡

All the wild asses are large, fine, swift animals, presenting a very different appearance in height, sleekness, and vivacity, to our poor domestic and degenerate ass. While the latter is remarkable for tardiness of step and mean appearance, and proverbially dull, obstinate, and stupid, the reverse is the case in the East, where, under better treatment and more genial skies, it is noted for docility, activity, and swiftness, as well as elegance of form. The Egyptian Arabs give it precedence over all other quadrupeds for intelligence and sagacity, and relate many anecdotes in support of this opinion. Major Denholm informs us that the Mandarah Valleys, Central Africa, contain a very fine breed of asses, which are used as beasts of burden. Monro, in his *Travels in Syria*, (i. 61,) states that at Mount Carmel he procured the finest ass he ever saw, and which he was told would sell for more than both his horses. With all the animation and

* *Cyropædia*, lib. i.
† Buffon, *Hist. Nat.* x. 175.
‡ *Magazine of Nat. Hist.* (1834,) vii, p. 319.

temper of a horse, it had the superior qualification of being quicker and easier in its walk. At the meeting of the Highland and Agricultural Society at Dundee, August 1843, Mr Thomas Gowans of Addinbrae Mill, Mid-Lothian, exhibited a very handsome ass of the Gazo breed, bred at Malta, and purchased there in 1842. His limbs were as straight as those of a horse, and his figure, size, and breeding were far superior to those of any ass bred in this country. In 1828, the Duke of Buckingham had, at his seat at Avington, a team of Spanish asses, which were extremely tractable, and took very freely to the collar. In Britain, the nature and disposition of the ass is quite destroyed through carelessness and cruelty—

> "The ass grows dull by stripes, the constant blow
> Beats off his briskness, and he moves but slow."

But among the peasantry of Spain the ass is a petted favourite, almost an inmate of the household. The children welcome him home, and the wife feeds him from her hands. Under this kind treatment his intellect expands, and what we denounce as the most stupid of animals actually becomes sagacious, following his master, and coming and going at his bidding. Mrs Child relates, that a Spanish peasant and his ass had daily, for many years, carried milk round to several customers in Madrid, till at length the peasant became very ill, and had no one to send to market. At the suggestion of his wife, the panniers were filled with canisters of milk; an inscription, written by the priest, requested customers to measure their own milk, and return the vessels; and the ass went off with his load. He returned in due time with empty canisters, and thus he continued to go to and fro for several days. In Madrid, the house-bells usually pull downwards, and the ass stopped before the door of every customer, and, after waiting a reasonable time, pulled the bell with his mouth.*

Mention is made of the ass in Britain as early as the time of King Ethelred, (866-872,) and at a later period, in the reign of King Henry the Third. But, from either disuse or some fatality, the ass was entirely lost among us during the reign of Queen Elizabeth. Holinshed informs us that in his time "our lande did yeelde no asses;" and in Johnson's *Relations of the Most Famous Kingdoms*, (1611, p. 40,) it is stated that England "bringeth not forth mules or asses, but of horse infinite proportions." It was probably during the reign of James the First that the ass was introduced into England for the second time; for, during his sovereignty, we renewed our intercourse with Spain,

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* *Letters from New York.*

in which country the animal is in general use and great pei
tion.

It has been often justly observed, that we know less of the ture of those animals which are our most constant compan than of those which are wild and afar off. This is easily counted for, from the obvious fact, that these animals, having since exchanged a life of independence in a state of nature, one of servitude in an artificial state, retain consequently bu imperfect notion of their proper habits. Can we find in the c paratively miserable hackney that acuteness and constant ı all the senses which the free, the fleet, and spirited horse or plains still displays? The latter must use all its faculties in plying its wants, and exert all its energies and cunning to ı tain its freedom; but the former has probably no idea of li in a herd with a leader at the head, and never dreams of sandy plains, or of any diet richer than hay and oats. So with the poor domestic ass. What can we expect from an mal that we hardly ever maintain in good condition or g spirits? The poor ass is cudgelled from its youth; and no gives it that fair unprejudiced trial which every British sub be he man or ass, is fairly entitled to. A wretched maltre horse is often as dull and obstinate as an ass. Not a few and some of great ability, have taken up the defence of thu used animal. "The ass," said the prophet of old, "knoweth master's crib;" but the ass of our times is not so fortunate, as a pleasant writer observes, the poor beast is utterly u quainted with the nature of a rack, and knoweth not even of existence of a manger. He is a houseless vagrant over comn and along lane sides; he is a beast among gypsies, and a g among beasts. He is unfed, untended, unpitied; he is ra kicked, spurred, thumped, lashed, tormented, troubled, thrashed in every possible and devisable fashion—and for w Your "most exquisite reason, good public? Alas! he is- ass!" * In a tract, entitled "*The Noblenesse of the Asse*, a v rare, learned, and excellent, by A. B.," (1595,) the author ren that this animal "refuseth no burthen, he goes whither he without any contradiction. He lifts not his foot against any (he bites not, he is no fugitive, nor maliciously affected. He (all things in good sort, and to his liking who hath cause to ploy him. If strokes be given him, he cares not for them; as our modern poet singeth,

"Thou would'st, perhaps, he should become thy foe,
And to that end doost beat him many times;
He cares not for himselfe, much lesse thy blowe."

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* *Blackwood's Magazine*, January 1840, p. 57.

In that pleasantly written book, *Spectacle de la Nature: or Nature Displayed*, (1744,) it is said of the ass that "The whole world cannot produce a more laborious creature, and at the same time one more indefatigable, abstemious, and patient. Not master of very shining qualities, he enjoys those that are very solid. His voice is not altogether melodious, but then, a fine voice hath very little merit with people of solidity. With him the want of a noble air hath its compensation in a mild and modest countenance; and instead of the boisterous and irregular qualities of the horse, which are frequently more incommodious than agreeable, the behaviour of the ass is entirely simple and unaffected; no supercilious and self-sufficient air. He marches with a very uniform pace, and though he is not extraordinarily swift, he pursues his journey for a long time, and without intermission. He finishes his work in silence, serves you with a steady perseverance, and discovers no ostentation in his proceedings, which is certainly a considerable accomplishment in a domestic. His meats require no preparation, for he is certainly well contented with the first thistle that presents itself in his way; he does not pretend any thing is due to him, and never appears squeamish nor dissatisfied; he thankfully accepts whatever is offered him; he hath an elegant relish for the best things, and very civilly contents himself with the most indifferent. His occupations have a tinge of the meanness of those who set him to work, but the judgments that are formed both of the ass and his master are equally partial, for the ass is perpetually at the service of poor peasants and artisans, who are the souls and sinews of the community." Cornelius Agrippa, in his celebrated treatise on the *Vanity of the Arts and Sciences*, has entered into an amusing dissertation on the ass. "In the old law," says he, "God so far honoured the ass, that when he commanded every first begotten to be slain for sacrifice, he only exempted men and asses. Christ, ascending to Jerusalem in triumph for the redemption of mankind, rode upon an ass; and we hear that Abraham, the father of the elect, rode only upon asses. So that the proverb commonly repeated among the vulgar is not spoken in vain—*that the ass carries mysteries*."

The popular belief, that the mark across the back of the ass is derived from Christ having rode on one into Jerusalem, is mentioned by Sir Thomas Browne, in his *Vulgar Errors*.* Whether it be of sacred origin or not, (and there is every reason for supposing it is merely a natural characteristic,) the hairs taken from this cruciform mark are highly prized by superstitious and ignorant persons as a cure for that distressing and sometimes fatal

* See Ellis's edition of Brande's *Popular Antiquities*, iii. 195.

disorder, the hooping-cough. Three of these hairs put in a muslin bag are hung round the neck of the suffering child. Some difficulty, however, is experienced in procuring these hairs, as it is believed that the ass from which they are taken is never worth any thing afterwards; and further, that it is essential to the success of the charm that the animal which supplies the hairs should be of the opposite sex to that of the patient. About eight years since, in the parish of Ludgvan, near Penzance, there was practised the curious custom of drawing children three times over the back and under the belly of an ass three years old to cure the hooping-cough. This having been done, three hairs were pulled out of the animal; and these were boiled in three table spoonfuls of milk, and the milk was then administered to the little patient for three mornings. The lower class in Dublin, also, fancy that children may be charmed from *ever* having the hooping-cough, and the charm, which is often performed in the streets, consists in passing the child three times over and under the body of an ass, into whose mouth is put a piece of bread.

If the size of the brain, in comparison to that of the body, can prove the intellectual superiority of an animal, then the ass would make a wiser consul than Caligula's horse. In the ass, there is one part brain for every two hundred and fifty-four parts of the grosser materials; while in the horse there is only one part of the former to every four hundred, or, in some cases, to every seven hundred parts of the other elements. Phrenologists, therefore, should bring asses into fashion, and elect them to the highest appointments, until the horses, by being longer kept at the riding-schools, have acquired cerebrums and cerebellums of larger and more creditable dimensions.

The ass differs much in size and abilities according to the climate it inhabits. In the genial warmth of its native plains, it is of large size, active, and vigorous. Colonel Sykes says, the common notion is incorrect, namely, that the largest asses are found at the tropics, and that they diminish in size according as they approach towards the north; for the reverse is in many instances the fact, in some parts of India the asses which are used as beasts of burden being little larger than Newfoundland dogs.

In its domestic state, the ass sometimes varies also in colour. A perfectly white one is recorded in the *Magazine of Natural History*, (vi. 67.) In 1833, an ass, the property of Mr Watson of Hammerton, produced a foal which was perfectly white, with the exception of a red tinge near its tail, and another near one of its shoulders, which were without those stripes that are seen on all other asses. In the same year, I noticed on Hampstead Heath an ass of a milk-white colour all over, excepting a trifling sprinkling of light brown upon its back. Mr J. B. Fraser says, that in

Bagdad "most of the learned and holy professions prefer the ass, and so do all the ladies. These asses are, I believe, of a particular breed, and from forty to fifty pounds sterling is no uncommon sum for one of great size, good blood, and fine paces. The favourite colour is spotless white; they are magnificently caparisoned, and have their nostrils slit, (a practice prevalent also in Persia,) which is said to make them long-winded. Heaven knows their wind is long enough when they begin to bray!" * Dr E. Hogg states, that in Alexandria people of all classes and countries ride on asses, and that women of the better class are often seen mounted astride upon them, their feet placed in short stirrups, the saddles of the animals covered with rich carpets, an attendant holding the bridle, and one or two others following, according to their rank.† At Hayti, in the West Indies, immense numbers of asses are in use, and their large size, sleek and glossy condition, together with their excellent training, excite every traveller's admiration. Cavalcades of from three to six, tied together, trot on unstimulated by word or blow from the owner, who rides on one, with, perhaps, his wife on a second, and his lusty and helpful boy on another. As the great utility of these asses secures them from ill-treatment, they are neither slow, stupid, nor headstrong. In England, at places of pleasurable resort, as Tunbridge Wells, Blackheath, and Hampstead Heath, ladies have no hesitation to ride about upon asses. It was in the year 1801 that Lady G. Seymour first set the fashion of riding upon them at Tunbridge Wells, a novelty which called forth many poetic effusions complimentary to the condescension of the fair sex.

On the first introduction of the ass into Britain, he appears to have been employed to carry ore from the mines in the mountainous parts of the kingdom, from his being more sure-footed than the horse. The ancient Neapolitans appear to have used the ass in grinding their flour; for on both sides of the walls of the north entrance to the Pantheon, at Pompeii, are representations of Cupids making bread, with a mill and an ass on each side. In fact, Columella states that the ass was often used in grinding corn in mills, in drawing heavy carts, and in ploughing. Its employment for the latter purpose is alluded to in scripture:—"Thou shalt not plough with an ox and an ass together," (Deut. xxii. 10.) In the *Irish Farmer's Magazine*, (i. 34,) is a figure of an American donkey plough, then recently introduced into Ireland by Mr George Stoney, of Oakly-Park, King's County. Though sufficiently light to be drawn by an ass, it is capable of

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* *Travels in Koordistan, &c.*

† *Visit to Alexandria,* (1835.)

turning the soil to the depth of nine or ten inches. A man and ass will, with ease, turn over half an English acre per day, which would require at least twenty spades to accomplish in the same time, and for most purposes the plough will answer equally well; indeed, another Irish gentleman who had one, not only worked his garden with it, but used it with perfect success in the cultivation of the potatoes, turnips, &c., on his farm. By the addition of mould-boards and a drill-harrow, the implement would greatly assist the small farmer in the cultivation of his ground. The simplicity of this plough is such, that any handy labourer might construct it in a few hours. The muzzle is fastened to the beam by means of a bolt, which answers as a wrench to turn the few nuts required in putting the plough together. No coulter appears in this plough, for where no sod is to be cut, it is not wanted. Some persons have had a coulter and iron share added, to answer required purposes; but in the American original, a metal plate, which fits into a recess in the mould-board, is the only share used. The metals may be had complete for the sum of ten shillings. At Carisbrook Castle, Isle of Wight, an ass, without any bridle or other harness on, works a great wooden tread-wheel, used in drawing up buckets full of water from a well, more than three hundred feet deep. At a word from a man, who owns no whip, the ass springs directly into the interior of the wheel, which is hollow, and furnished with projecting wooden steps inside, the hollow part of the wheel being broad enough to admit of the ass between its two sets of spokes. The animal walks up the steps of the wheel in the same manner as the troublesome gentry do at the treadmill, and while he is making the machine revolve, he keeps an anxious look-out for the bucket, and directly that he perceives that he has drawn it up to the surface, he very deliberately walks out of the wheel to his former place of standing.

Under kind treatment the ass is capable of attachment towards its owner. Wordsworth tells us how a fond and faithful ass stood over the drowned corpse of his master, sorrowing, solitary, starving, and motionless.

In Fielding's *Select Proverbs of all Nations*, (1824,) it is mentioned, as a popular but erroneous notion, that a statute exists, "obliging the owners of asses to crop their ears, lest the length of them should frighten the horses they meet on the road."

The bray of the ass is not generally admired, but the author of the scarce treatise on *The Noblenesse of the Asse*, (1595,) declares that "The goodly sweet and continual braying of asses forms a melodious and proportionable kinde of musick. Nor think I that any musician can deny that their song is full of exceeding pleasure to be heard; because therein is to be discerned concord, discord, singing in the meane, the beginning to sing in large compasse,

then following to rise and fall, the half note, whole note, musick of five voices, firme singing by four voices, or one voice and a half. Then their varlable contrarieties amongst them, when one delivers forth a long tenor, or a short, the pausing for time, breathing in measure, breaking the minim or very least moment of time. Last of all, to hear the musick of five or six asses, is to hear a song of world without end." We read in fable, that an ass being appointed judge in a trial of skill in singing, between a cuckoo and a nightingale, declared that the nightingale sung extremely well, but for a good plain song, the cuckoo was far his superior. It is related, too, that once while St Francis was preaching to a crowded congregation—

> ——" A braying ass
> Did sing most loud and clear."

This threw his audience into confusion; but St Francis, turning round to the animal, said, "Brother donkey, pray keep yourself quiet, and permit me to preach to the people." Upon which the ass placed its head between its legs, in an attitude of attention, and remained perfectly quiet.

Cornelius Agrippa says, the ass is never troubled with any diseases or with lice, and the old writer on its *Noblenesse*, also, asserts that—

> ——" On it is ne'er engendered
> The hateful vermin that doth teare the skin,
> And to the body make their passage in;"

but unfortunately for this notion, which Goldsmith and other modern authors repeat, Redi has figured a *Pediculus Asini* in his *Experimenta circa Generationem Insectorum*, (1686,) tab. xxi.

The ass is an excellent swimmer. In March 1816, one belonging to Captain Dundas, then at Malta, was shipped on board the Yster frigate, bound from Gibraltar to that island. During a storm at sea, all the live stock was thrown overboard. The ass swam to shore at Point de Gat, and made his way thence to Gibraltar, a distance of two hundred miles, through a mountainous country, and at length made his appearance at the door of the stable he had last inhabited.

In a wild state, the ass feeds chiefly on the most saline and bitter plants of the desert, as the *Kalis*, *Atriplices*, *Chenopodium*, &c. The domestic ass is even content to make a meal off a little bran, or a few withered leaves. Crassus, a distinguished Roman, never laughed in his life but once, and that at an ass eating thistles; and Philemon, who lived two hundred and seventy-four years before Christ, is stated to have even died with laughter, on seeing an ass eating figs off a silver plate. If it gives preference to any wild plant, it is to the plantain, for which it has been often

observed to neglect every other herb in the field. It also browses upon the young sprouts of live fences, as Rogers notices—

"Oft o'er the mead, at pleasing distance pass,
Browsing the hedge by fits, the pannier'd ass."

Though our translation does not explicitly state the fact, it is clear, from the Hebrew original, that the Israelites fed their asses on chaff, or cut straw, and barley, (Judges xix. 21: 1 Kings, iv. 28.) David had so many asses employed upon his extensive estate, that he had an overseer to superintend them, (1 Chron. xxvii. 25-31;) and we read that Job kept a thousand she-asses, (Job. i. 3; xliii. 12.) Cornelius Agrippa compares the ass to a scholar, because it lives on little food, and is contented with whatsoever it be, whether lettuces, brambles, or thistles, and patiently endures hunger, penury, labour, stripes, and all manner of persecution.

Bryant says the ass has the faculty of discovering distant water by the smell; but I apprehend that this is only when it inhales the saline emanations from those brackish waters, which it prefers, at least in its wild state. The domestic ass is more particular in the choice of water than food, for water which a horse will gladly drink, is often not clean enough for an ass. This fact did not escape Shakspeare's observation—

"Would *the fountain* of your mind *were clear again*, that
I might water an ass at it."—(*Troilus and Cressida*, iii. 3.)

Professor Gmelin states, that a female wild ass, which he brought to St Petersburgh, sometimes passed two days without drinking.

The ass goes with young twelve months. Franzius assures us, "There is no creature so fruitful as this, for she is with young when she is but young herself, and so continueth still to have colts, until she is thirty years old." * She is much attached to her young, which is a sprightly little creature in its youth, but soon assumes the gravity of its parent, when old enough to stand blows, and other maltreatment. Obscure dark bands are frequently observable on the legs of the young ass, as in other animals of its genus.

The milk of the ass is a wholesome drink, and therefore highly commended by medical men. A gentleman who was restored to excellent health by chiefly drinking asses' milk, and taking regular exercise on horseback, used facetiously to say, his apothecary was an ass, and his physician a horse. Dr Thomas Muffet tells us, that "asses' milk cleanses, cows' milk loosens, and goats' milk strengthens more than any. Asses' milk is not so thin but

* *History of Brutes*, 1670, p. 112.

that it nourisheth much, nor so thick as that easily it will curdle. It may be drank without being boiled, for it will never curdle into any hard substance, nor engender wind. When Poppoea, wife to Domitius Nero, carried five hundred she asses, (shod with gold) continually about with her, to bathe her body in their milk once a week, and to drink of it every day, to make her skin clear and smooth without wrinkles, she left it rather a monument of her pride, than a memorial of her wisdom; for if she had taken it (as the Arcadians do cows' milk) in the spring time only, for a month or six weeks together, once in the morning, to cleanse and purge the body of bad humours, it had been good and warrantable by physick. Consumptions, wherein the flesh accidentally decayeth through exulceration of the lungs and breathing parts, is especially to be cured by asses' milk; whereas asses' milk is both meat and medicine, cleansing and nourishing alike, not so thin as to hinder expectoration, nor so thick as to cause condensation of the matter putrified, but being of a middle temper and consistence, and consequently most proper for that disease. Neither are all asses of alike goodness; for a young ass's milk is too thick and dry, but one of a middle age is best for that purpose. Having got such a one, every morning (four or five hours before you use her milk) shut her from her foal, and curry her well and clean, lest her skin growing scurvy and foul, ill-vapours be augmented inwardly for want of expiration then feed her with grinded malt, straw-dried, mingled with a little sweet fennel seed, aniseed, or caraway seed, which she will eat with great pleasure, and digest into a sweet and wholesome blood. An hour after that, milk her as near the patient as conveniently as you can, that he may drink her milk ere the air hath altered it, for if it be once cold it is never wholesome This is to be done twice a day, morning and evening, upon an empty stomach, neither eating nor drinking aught after it for two hours; you may sweeten it also with sugar-candy, sugar of rodes, or fine maiden honey, it will be the more effectual. As soon as the ass is milked, turn her and her foal into fine leas wherein store of cowslips, trefoil, cinquefoil, elecampane, burnet, filipendula, mead-tansy, horsetail, plantain, lambs-tongue, scabious, and lungwort groweth. In winter, feed her with the sweetest hay growing in the finest and best meadows." * It is universally known, that cows, goats, and many other animals that have brought forth young, continue to give milk, not only after the young are removed, but even for years, when the im-

* *Health's Improvement, or Rules discovering all Sorts of Food.* (1655.)

pression of having had young must have been entirely forgotten; but the ass ceases to yield milk after she has lost the impression of the existence of her foal. This fact is so well known to the keepers of asses, that whenever the foal dies, they strip off its skin, and preserve it, so that it may occasionally be thrown over the back of another foal, and smelled by the mother, more particularly at the time they are milking her. The ass, being thus under the deception of having her own foal, yields milk, the secretion of it being carried on as usual; but if this artifice is neglected, she soon gets dry. This appeared to John Hunter so incredible, that he resolved to put the statement to the test of experiment. He took an ass in milk, that had a foal, and kept them apart every night, but had the mother milked in the morning in the presence of the foal. This was done for more than a month without there being any diminution in the morning's milk. The foal was then taken away altogether, and the mother was milked, particularly in the evening, at the same hour at which the foal had been taken from her, and again the morning at the usual hour. The milk taken in the morning was always compared with that taken the morning before, but in three mornings there was hardly any. The foal was then restored to her, but she would not allow it to suck. The experiment was repeated, with similar results. As it is sometimes difficult for invalids to procure asses' milk, it may be useful to mention, that a good substitute for it may be made by pouring half a pint of soda-water over a wine glassful of boiling milk, drinking it immediately.*

The modern Persians, according to Mr Morier's statement, eat the flesh of the wild ass, and declare it to be better than that of the antelope. The ancients did the same; and it must be supposed that when Herodotus classes the ass among the animals which the rich Persians roasted whole and ate when they indulged themselves in better fare than usual, he means the wild ass.† It appears to have been much more plentiful in the days of Olearius, (A. D, 1637,) who says that, at an entertainment given by Shah Abbas to the ambassadors, thirty-two wild asses were turned into an enclosure to be shot at, and remarks that their flesh was esteemed so excellent as to be fit for the king's food.‡ Dr Muffet quaintly observes, that "Mæcenas so highly loved asses' flesh, that all Italy was too little to find him asses enough." In the *Second Book of Kings* (vi. 35,) we read, that such was the scarcity of food, that an ass's head was sold for fourscore pieces

* For the chemical analysis of asses' milk, see M. E. Peligot's memoir in Jameson's *Edinburgh Philosophical Journal*, No. xliii, (1836.)

†Herodotus, *Clio*. 133.

‡ Olearius's *Travels*, p. 735.

of silver. The Chinese esteem the head of an ass as one of the greatest delicacies, and the flesh of the quagga is a favourite food with the South Africans. Sonnini thinks that the djiggutais will become extinct, owing to man being unable to subjugate them, and their being a favourite delicacy with the Asiatics.

Sagri, or, as we call it, shagreen, is made of the ass's hide, which in this country is used for shoe-leather. The animal's integuments are hard and elastic, and form good parchment, which is used for pocket tablets and for drums. Its bones, being very solid, were made into very superior flutes by the ancients.

Lord Bacon says, "the ass lives commonly to the horse's age." Several of the asses employed at the well at Carisbrook Castle, attained a good age in that service. One is recorded to have worked the wheel for fifty two years, when it died, in perfect health and strength, by falling over the castle ramparts. A second lived to the age of forty; and a third attained to thirty. For several years, one of these enjoyed a pension of a penny loaf a day, settled on it by the Duke of Gloucester, uncle of George the Third. An aged inhabitant of Langport, near Lewes, desired, when on his deathbed, that an old donkey, which he had ridden for forty years, should be killed, and buried by his side; and a poem upon this subject is contained in a volume, entitled, "*Attempts in Verse*, by John Jones, an old servant," edited by the late poet-laureate.

*Thomson on the Food of Animals.**—The importance of the subject to which this work relates cannot easily be over-estimated. A more accurate knowledge than we now posses of the modes in which different kinds of food are affected by the digestive process, the readiness with which they are assimulated to the system, and consequently their capacity as to the power of nutrition, would be of the greatest practical utility, and would probably lead us to modify the dietary treatment of nearly all our domesticated animals. Yet it is surprising how little has been done, still more so, how little has even been attempted, to throw light on this important matter. In this, as in most other branches of his avocation, the farmer has to be guided by the results of experience, obliged to depend on a kind of empirical knowledge, and be satisfied with certain effects, without well knowing how these are produced; and, consequently, without much power of modifying them, or giving them such a direction as might most effectually promote his interests. It must be admitted that the subject is

* Experimental Remarks on the Food of Animals and the Fattening of Cattle. With Remarks on the food of man. By Robert Dundas Thomson, M.D., Lecturer on Practical Chemistry, University of Glasgow. London, Longman and Co., 1846.

encompassed with difficulties. The whole process of digestion and nutrition is exceedingly complex, obscure in its own nature, and carried on in regions of the system nearly or altogether inaccessible to observation. Even were we acquainted with the whole chemistry and mechanism of the subject, able to assign their due office and proportion to all the acids, alkalis, gases, &c., which take a share in the process, we should still be very far from having a perfect understanding of it. The nervous action —the general influence of the vital principal—are obviously agents of the first importance, and are so mysterious in their operations, that we can scarcely hope to get into the secret of their modes of action. But while there may be much, as in the analogous phenomena of generation, which is likely even to bid defiance to our scrutiny, not a little remains on which much light may be thrown, and much practical information elicited, by a series of judicious, ingenious, and enlightened experiments.

Such, we have no hesitation in affirming, is the character of the experiments recorded in this little volume. Dr Thomson is well qualified for such an undertaking, not only by his knowledge of chemistry, but by his skill as a physician, and habitual acquaintaince with the habits and characters of animals. The experiments in question were undertaken at the instance of the late government. The original object of the inquiry was to determine the relative influence of barley and malt in feeding cattle; but advantage was taken of the opportunity to investigate some scientific problems of great importance to physiology, and of extreme value in the physicial management of man and animals.

Of a work containing so many minute details, and exhibiting the results obtained chiefly in a tabular form, we cannot attempt a complete analysis in this place, but shall endeavour to point out some of the most important conclusions to which these experiments have led; and first, as to the comparative merits of barley and malt diet in feeding cattle, the primary object which these investigations had in view. It may be premised, that all the experiments were made with two cows of the Ayrshire breed, between five and six years of age.

It appears that barley and malt, when not crushed, although steeped in hot water, are imperfectly digested by cows. It was observed that some of the grains of barley were ejected from the intestines 24·28, and even seventy-two hours after being swallowed, in an entire state, so that they must have been detained in some portion of the alimentary canal, during that lengthened period, without having undergone any appearance of digestion. The indigestible nature of seed in general is well known, and has usually been regarded as a natural provision for the distribu-

tion of vegetables by means of animals. It is in the rind or outer coating of the seed that this power of resistance usually resides, and when that is broken the gastric juices readily act upon the internal substance. In every case, therefore, in which any kind of grain is given to cattle, care should be taken to break the outer covering.

The first experiments detailed by Dr Thomson, in his chapter on barley and malt diet, demonstrates the truth of the following position:—

A cow, if fed for two days on an insufficient quantity of food, as indicated by loss of weight and diminution of milk, will require at least double that time to reach the condition from which it had deteriorated; and the reason of this is obvious, because partial starvation has caused it to lose a portion of the solid part of the body, which requires a longer time to re-establish than to pull down. This rule is applicable to the dietary of men as well as the inferior animals. An increase of labour should always be accompanied by an increase of food, both at sea and in prison; a short walk to one confined in a solitary cell, calls for some augmentation of food. A slight increase of temperature, or the irritating influence of insects, will effectually diminish the milk of a cow, and indicates the propriety of increasing the amount of the fodder.—p. 82.

In the experiment detailed with the entire malt and barley, the amount of grass was limited, but afterwards the hay was supplied *at libitum*. Previous to the experiment both the cows had been gaining weight on a diet of grass, consisting almost entirely of ryegrass; but under the diet here indicated the falling off was considerable. By comparing this experiment with a previous one, it was found that, while 100 lbs. of dry grass produce about 11½ lbs. of dry milk, 100 lbs. of dry grass and entire barley mixed, produce 8½ lbs. of dry milk.

Grass alone produces a larger quantity of dung than mixed barley and grass fodder; 100 lbs. of grass leaving 33½ lbs. of dung, while barley and grass produce only 30 lbs. of dung; but 100 lbs. of the grass consumed, that is, the grass taken into the circulation of the animal, and not rejected in the form of dung, produces 17½ lbs. of dry milk, while 100 lbs. of the mixed barley and grass diet form only 12 lbs. of dry milk. . . . Another important deduction is, that the total quantity of matter taken into the circulation daily is less when grass is alone used, than when a mixed diet is employed; the daily consumption being of dry grass, by both cows, 33½ lbs., and of the mixed diet 42 lbs., being a difference of 9 lbs., or 4½ lbs. by each cow.—p. 88.

The ultimate composition of the barley was found to be as follows:—

	I.		II.	III.	IV.
Carbon,	46·11	41·64			
Hydrogen	6·65	6·02			
Nitrogen,	1·91	1·81	2·01	1·98	1·95
Oxygen,	42·24	38·28			
Ash,	3·09	2·79			
Water,		9·46			
	100·	100·			

Experiments were then made with entire malt soaked in boiling water, along with grass; and, according to these trials, the barley and malt (entire) experiments may be compared as follows:—

I. *Milk ;*

100 lbs. of hay and barley produce	. .	8·41 lbs. of dry milk.
100 lbs. of hay and malt produce	. .	7·08 ditto.

II. *Butter ;*

100 lbs. hay and barley produce	. .	1·82 lbs. butter.
100 lbs. hay and malt produce	. .	2·07 ditto.

III. *Weight of Cattle ;*

	lbs.	Loss. lbs.
Weight of cattle before barley experiment, .	2030	0
Weight of cattle after do. . . .	1989	41
Weight of cattle before malt do. . .	2044	0
Weight of cattle after do. . . .	2022	22

The next experiments related to crushed barley and malt steeped in boiling water, hay being at the same time supplied; and in the malt experiment the amount of grain having been pushed further than in the case of barley, it was considered ad. visable to give a similar trial to that of grain. The result of this went to prove, that no advantage is gained by giving so much grain; but that, on the contrary, a deteriorating effect is produced- The comparison may be thus stated:—

I. *Milk ;*

100 lbs. of mixed barley, hay, and grass, produced		8·17 lbs. of milk.
100 lbs. of mixed malt and hay produced	.	7·95 do.

Butter ;

100 lbs. of barley, hay, and grass, produeed	.	1·95 lbs. of butter.
100 lbs. of malt and hay, produeed	. .	1·92 do.

III. *Weight of Cattle ;*

	lbs.	Gain.	Loss.
Weight of cattle before barley experiment, .	2022	...	...
Do. do. after do.	2111	89	...
Do. do. after malt, ...	2069	...	42

According to this view of the experiment, it appears that the malt produces a smaller amount of milk and butter when combined with hay, than in the barley experiment; and that the cattle were losing weight, and consequently strength, daily. In whatever manner, therefore, we view the experiment, this is an insurmountable objection to the use of malt--that it is not capable, when used in any quantity, comparatively with barley, to sustain the weight and consequent strength of animals. But there is another aspect in which the experiment should be examined, and this is obviously the correct one, since a larger quantity of malt was used than of barley. If we consider the hay a constant quantity, and then calculate the amount of product which would comparatively result from such grain, the consequences would be as follows:—

I. *Milk;*

100 lbs. of barley would produce	.	34·6 lbs. dry milk.
100 lbs. of malt would produce	.	26·2 do.

II. *Butter;*

100 lbs of barley would produce	.	7·66 lbs. of butter.
100 lbs. of malt would produce	.	6·35 do. do.

By the present mode of comparison, then, it appears that, in every point of view, malt is inferior to barley us an article of diet for cattle, as it gives less milk and butter, and diminishes the live weight, instead of increasing it, which barley does under the same circumstances.—p. 104–105.

With this important conclusion, which the author proceeds to account for by a chemical examination of barley and malt, we must leave this part of the subject, all his observations on which are highly deserving of attention.

Various experiments were instituted with a view to determine the effect of molasses, linseed, and beans, in the production of milk and butter; and the result was as follows:—

	lbs.
I. *Milk;*	
1000 lbs. of hay, barley, and molasses, produce of dry milk,	80·6
1000 lbs. of hay, barley, and linseed,	84·5
1000 lbs. of ditto, and bean meal,	81·3
II. *Butter;*	
1000 lbs. of hay, barley, and molasses, produce butter,	21·9
1000 lbs. of hay, barley, and linseed,	21·5
1000 lbs. ditto, and bean meal,	22·5

or, considering the hay a constant quantity, then we have the result as follows:—

	lbs.
I. *Milk;*	
1000 lbs. barley and molasses produce of milk,	23·7
1000 lbs. ditto linseed,	25·7
1000 lbs. bean meal,	25·2
II. *Butter;*	
1000 lbs. barley and molasses produce of butter,	64·5
1000 lbs. ditto linseed,	63·7
1000 lbs. bean meal,	70·0

It appears that a change of food produces an increase in the quantity of milk; after the same diet has been continued for some days, the milk begins to diminish. Not only is variety requisite when the animal is in an artificial state, it is likewise beneficial when in a condition more akin to nature. It is on this principle, the author thinks, that we are to account for the superior influence of old natural pastures, which consist of a variety of grasses and other plants, over those pastures which are formed of only one grass, in the production of fat cattle and good milk cows. He thinks, that cattle in a state of confinement would be benefited by a frequent, almost a daily, change or modification in their food. Taking the mean of the produce of the two cows experi-

mented upon, we find that the relative influence of the different kinds of food in the production of milk to be; malt 102·66 lbs. of milk; barley and molasses, 106¾; bean meal, 107·68; barley, 108; barley and linseed, 109. The author considers that no adequate advantage can be attained by pushing the supply of barley to a cow beyond the extent of 9 lbs. daily. In general, the same induction may be made with reference to malt as to barley, that, in a remunerative point of view, 9 lbs. a-day may be considered a larger proportion of malt to supply a cow. It is highly probable, indeed, that a smaller quantity will be found fully as efficient.

It is not a little surprising how great a quantity of water can be taken in by cows, even when the stomach is in a condition of engorgement with food They will swallow what is more than sufficient to fill the whole cavities of the stomach, even supposing they were empty. The following table shows the quantity of water swallowed by two cows on different occasions. They were placed on the weighing-machine, and their weight noted. They were then allowed to satisfy their thirst, and their weight again taken.

BROWN COW.

	Food.	Weight of Cow.		Water swallowed.
		Before drinking.	After drinking.	
		lbs.	lbs.	lbs.
12th August,	Barley, molasses, and hay,	1010	1038	28
19th —	Malt and hay, ...	998½	1041	42½
29th —	Do. do.	1023½	1048	25
4th Sept.	Barley, linseed, and hay,	991	1055	63

WHITE COW.

	Food.	Weight of Cow.		Water swallowed.
		Before drinking.	After drinking.	
		lbs.	lbs.	lbs.
12th August,	Barley, molasses, and hay,	1052	1106	54
26th —	Malt and hay, ...	1028	1051	23
4th Sept.	Barley, linseed, and hay, .	1056	1104	48
13th —	Beans and hay, ...	1060	1087	27

In such cases the water must have passed through the stomach into the intestines, probably into the colon, which then serves as a reservoir for the fluid. The brown cow swallowed at one draught sixty-three pounds of water. As the water was derived from the Clyde, and contained but a small amount of inorganic matter, we shall be very near the truth, says Dr Thomson, if we admit that the cow, on this occasion, swallowed six gallons of water without taking a breath.

Much has recently been said, both in jest and earnest, about the absurdity of feeding cattle into such a monstrous condition of fatness as we commonly see them at agricultural shows. This undue deposition of fat, a condition of the system which is ranked in the human subject as a disease, (*Polysarcia adiposa*,) Dr Thomson regards in the same light when exemplified in animals. He says, "When cattle are fed for the purpose of serving as human food, there ought not to be such a superabundance of fatty matter deposited, as is usual with some of the animal monsters designated fat cattle. When they are properly fed, with due attention to allowing them a certain amount of exercise, the fat and lean are deposited in healthy proportions, and the cattle may be employed without risk as human food."—p. 48.

We have said enough of this work to show the originality and value of its contents, as illustrative of the principles on which a sound system of dieting may be established, not only in regard to animals, but also in relation to human beings.

Want of space has obliged us to omit the usual Agricultural Report, and postpone several interesting papers.—EDITOR.

TABLE OF PRICES, &c.

e Average Prices of the different kinds of GRAIN, per Imperial Quarter, sold at the following Markets :—

LONDON.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1846.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
c. 5.	64 9	45 3	28 4	44 11	53 5	44 8
12.	63 6	45 4	26 9	43 0	58 7	45 0
19.	63 3	45 8	27 8	44 3	53 2	43 5
26.	65 3	45 10	28 1	44 6	53 5	45 7
1847.						
n. 2.	69 1	44 8	29 8	47 5	58 4	46 4
9.	70 2	50 1	28 10	46 0	52 6	45 11
16.	72 5	55 4	30 4	50 8	56 3	47 0
23.	74 11	57 0	34 1	55 4	55 7	52 7
30.	76 6	58 3	34 0	60 6	58 7	53 11

EDINBURGH.

Date.	Wheat.	Barley.	Oats.	Pease.	Beans.
1846.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 2.	58 2	38 2	22 0	48 0	48 6
9.	58 1	36 8	30 0	49 0	49 7
16.	60 0	39 2	32 1	48 6	49 2
23.	64 2	41 5	33 9	50 8	52 2
30.	65 2	43 3	34 8	51 0	52 0
1847.					
Jan. 6.	68 6	46 7	36 2	52 9	53 7
13.	70 9	53 6	41 9	58 10	59 10
20.	70 8	49 4	40 8	60 6	61 10
27.	68 4	48 6	36 10	58 6	59 3

LIVERPOOL.

Date.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1846.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
ec. 5.	59 8	38 2	30 4	42 4	60 3	50 1
12.	58 9	38 10	30 2	42 10	53 11	49 7
19.	59 9	41 5	30 8	43 2	54 4	51 7
26.	62 4	42 4	30 7	44 4	55 3	50 11
1847.						
n. 2.	64 7	41 9	31 11	46 2	55 10	53 8
9.	68 9	46 10	34 0	48 6	63 1	45 9
16.	72 11	40 9	36 5	49 8	53 4	54 5
23.	74 1	44 6	36 2	50 6	64 9	55 7
30.	76 0	46 4	35 11	53 2	77 0	56 6

DUBLIN.

Date.	Wheat, per bar. 20 st.	Barley, per bar. 16 st.	Bear, per bar. 16 st.	Oats, per bar. 14 st.	Flour. per bar. 9 st.
1846.	s. d.	s. d.	s. d.	s. d.	s. d.
Dec. 4.	36 10	22 2	21 0	19 0	22 6
11.	40 8	24 3	23 1	20 6	23 6
18.	41 8	26 4	23 6	21 4	24 8
25.	42 2	26 6	24 2	20 6	25 2
1847.					
Jan. 1.	42 8	26 3	25 4	20 11	25 4
8.	42 3	29 9	26 6	21 11	26 4
15.	45 4	29 6	27 2	22 4	26 8
22.	47 10	28 6	26 9	23 1	27 4
29.	47 8	25 11	23 8	21 6	

ABLE showing the Weekly Average Price of GRAIN, made up in terms of 7th and 8th Geo. IV., c. 58, and 5th Vict., c. 14, and the Aggregate Averages which regulate the Duties payable on FOREIGN CORN: the Duties payable thereon, from December 1846 to February 1847.

Date.	Wheat. Weekly Average.	Wheat. Aggreg. Average.	Wheat. Duty.	Barley. Weekly Average.	Barley. Aggreg. Average.	Barley. Duty.	Oats. Weekly Average.	Oats. Aggreg. Average.	Oats. Duty.	Rye. Weekly Average.	Rye. Aggreg. Average.	Rye. Duty.	Pease. Weekly Average.	Pease. Aggreg. Average.	Pease. Duty.	Beans. Weekly Average.	Beans. Aggreg. Average.	Beans. Duty.
1846.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
ec. 5.	59 7	60 7	4 0	42 11	43 2	2 0	26 7	26 7	1 6	42 5	42 4	2 0	48 0	49 6	2 0	45 4	46 2	2 0
12.	60 3	60 4	4 0	43 1	43 5	2 0	26 5	26 5	1 6	42 11	42 8	2 0	48 7	49 1	2 0	45 0	45 11	2 0
19.	59 10	59 11	4 0	42 11	43 2	2 0	26 3	26 4	1 6	43 1	43 10	2 0	48 10	49 9	2 0	44 8	45 8	2 0
26.	65 6	60 0	4 0	43 2	42 11	2 0	26 10	26 4	1 6	43 7	43 1	2 0	49 4	48 6	2 0	45 6	46 5	2 0
1847.																		
an. 2.	64 4	60 9	4 0	44 3	43 9	2 0	27 2	26 6	1 6	46 10	43 10	2 0	49 8	48 8	2 0	45 10	45 4	2 0
9.	66 10	62 1	4 0	46 5	43 9	2 0	27 10	26 10	1 6	46 4	44 2	2 0	51 7	49 4	2 0	47 0	45 7	2 0
16.	70 3	63 10	4 0	50 0	45 0	2 0	29 6	27 4	1 6	50 8	45 7	2 0	51 11	50 0	2 0	49 0	46 2	2 0
23.	73 3	66 0	4 0	54 6	46 10	2 0	31 2	28 2	1 6	51 6	47 0	2 0	54 11	51 1	2 0	51 1	47 2	2 0
30.	74 11	68 7	0 0	55 11	49 0	0 0	32 2	29 1	0 0	55 3	49 0	0 0	58 8	52 4	0 0	52 7	48 6	0 0

FOREIGN MARKETS, per Imperial Quarter, free on board.

Date.	Markets.	Wheat.	Barley.	Oats.	Rye.	Pease.	Beans.
1846. Dec.	Danzig.	53/ to 57/6	29/6 to 36/	17/ to 22/	35/ to 42/	40/ . 43/	41/6 . 44/
1847. Jan.	......	60/ . 64/	32/ . 38/	20/ . 26/	36/6 . 44/	42/ . 46/	43/ to 46/9
1846. Dec.	Hamburg.	50/ . 56/	26/ . 36/	20/3 . 24/	35/6 . 39/	41/6 . 47/6	42/6 . 45/
1847. Jan.	......	60/ . 65/3	28/6 . 38/6	22/6 . 26/6	40/ . 42/6	46/ . 52/	45/ . 50/
1846. Dec.	Bremen.	60/ . 66/	32/ . 37/6	18/6 . 25/	45/ . 54/6	48/ to 54/6	40/ . 44/
1847. Jan.	......	63/ . 68/	34/6 . 39/6	23/6 . 28/	46/ . 55/	50/ . 55/	42/6 . 49/
1846. Dec.	Konigsberg.	46/ . 58/6	30/9 . 33/6	20/ . 24/3	38/ . 46/	37/6 . 44/	40/ . 44/6
1847. Jan.	......	58/ . 63/6	34/6 . 38/3	22/6 . 27/	40/ . 48/	40/ . 48/6	44/ . 50/

Freight from the Baltic, from 4/6 to 7/6; and from 7/6 to 11/6 from Trieste, Alexandria, &c., to Great Britain.

THE REVENUE.

***ABSTRACT** of the Nett Produce of the Revenue of Great Britain, in the Quarters and Years ended on the 5th January 1846, and 5th January 1847—showing the Increase and Decrease on each head thereof.*

	Quarters ending January 5. 1846.	Quarters ending January 5. 1847.	Increase.	Decrease.	Years ending January 5. 1846.	Years ending January 5. 1847.	Increase.	Decrease.
Customs	£4,354,789	£4,514,721	£159,923	....	£18,105,206	£18,310,865	£205,659	....
Excise	3,338,837	3,608,155	269,318	....	12,177,112	12,521,250	344,138	....
Stamps........	1,792,402	1,740,687	....	£51,715	7,152,114	6,931,414	....	£220,700
Taxes	1,876,051	1,900,899	33,848	....	4,223,842	4,272,408	48,566	....
Post-Office....	189,000	203,000	14,000	....	731,000	816,000	85,000	....
Miscellaneous	93,612	59,657	....	33,955	240,317	437,090	196,773	....
Property Tax	386,985	450,219	63,234	....	5,026,570	5,395,391	368,821	....
	12,031,676	12,477,338	540,323	85,670	47,656,161	48,684,418	1,248,957	220,700
	Ded. decrease on Qr.		85,670	....	Deduct decrease on Yr.		220,700	....
	Increase on the Qr.		454,653	....	Increase on the Year.		1,028,257	....

PRICES of BUTCHER MEAT.

Date.	LONDON. Per stone of 14 lb. Beef.	LONDON. Mutton.	LIVERPOOL. Per stone of 14 lb. Beef.	LIVERPOOL. Mutton.	NEWCASTLE. Per stone of 14 lb. Beef.	NEWCASTLE. Mutton.	EDINBURGH. Per stone of 14 lb. Beef.	EDINBURGH. Mutton.	GLASGOW. Per stone of 14 lb. Beef.	GLASGOW. Mutton.
1846. Dec.	7/3 to 7/9	7/9 to 8/9	7/ to 8/	7/3 to 8/	6/9 to 7/6	7/ to 7/9	6/9 to 7/3	6/9 to 7/6	7/3 to 7/9	7/3 to 8/
1847. Jan.	7/3 . 8/	7/6 . 8/6	7/3 . 8/	7/ . 7/9	7/ . 7/9	7/3 - 8/	7/ . 7/6	6/9 . 7/3	7/3 . 7/9	7/3 . 8/

PRICES of English and Scotch WOOL.

ENGLISH, per 14 lb.		SCOTCH, per 14 lb.	
Merino, ...	13s. 6d. to 18s. 6d.	Leicester Hogg, . . .	12s. 0d. to 15s. 6d.
.... in grease, . . .	10s. 0d. ... 15s. 0d.	.... Ewe and Hogg, .	10s. 0d. ... 14s. 6d.
Southdown, . . .	14s. 0d. ... 19s. 0d.	Cheviot, white, . . .	8s. 6d. ... 12s. 6d.
Half bred.	11s. 0d. ... 16s. 0d.	.... Laid, washed, . .	6s. 0d. ... 10s. 0d.
Leicester Hogg, . . .	13s. 6d. ... 18s. 6d.	.... unwashed, .	5s. 0d. ... 9s. 0d.
.... Ewe and Hogg, .	10s. 6d. ... 16s. 0d.	Moor, white, ...	5s. 0d. ... 7s. 0d.
Locks, ...	6s. 0d. ... 9s. 0d.	.... Laid, washed, . .	4s. 0d. ... 6s. 6d.
Moor, ...	5s. 6d. ... 7s. 6d.	.... unwashed. .	3s. 0d. ... 5s. 0d.

INDEX.

EDINBURGH: BALLANTYNE AND HUGHES.